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Forest Service

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Region

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California Spotted Owl
Sierran Province
Interim Guidelines
Environmental Assessment

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SECTION I - PURPOSE AND NEED FOR ACTION

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SECTION I - PURPOSE AND NEED FOR ACTION

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Introduction

This section discusses the events leading up to this analysis, the proposed action and the underlying purpose and need for action to which the Forest Service is responding. Under the umbrella of the purpose and need, more specific analysis objectives are noted.

Background and Coordination with Other Agencies

Maintaining the viability of spotted owl populations in view of the many land management activities that occur within their habitats, has challenged public land managers for nearly two decades, with management policies hotly debated by a variety of interests. Although the controversy over Forest Service management has focused on the northern spotted owl, the California spotted owl has recently taken part of the spotlight.

During the 1980s, the Forest Service implemented a conservation strategy based on retention of Spotted Owl Habitat Areas (SOHAs) capable of supporting one to three pairs of owls, separated from each other by distances ranging from 6 to 12 miles which formed a network of territories. A comprehensive assessment of management of the northern spotted owl by the Interagency Scientific Committee (ISC) was released in April 1990 (Thomas et al. 1990). The ISC Report identified serious weaknesses in the SOHA strategy, calling it a "prescription for extinction" because it tended to isolate northern spotted owl populations and did not facilitate dispersal.

Because the SOHA strategy was also being utilized to manage the California subspecies of the spotted owl (a Forest Service designated Sensitive species), a technical assessment of the current status of the California subspecies was initiated cooperatively with the State of California. This led to the formation in June 1991 of an Interagency California Spotted Owl Steering Committee (Steering Committee). The Steering Committee included members from several State of California and Federal entities, and included observers from other State and local agencies and private interest groups, including timber industry and environmental group representatives.

The Steering Committee formed two investigative, advisory teams -- the California Spotted Owl Technical Team (Technical Team) and the Policy Implementation Planning Team (PIP Team). The charter of the Technical Team was to produce a report on the California spotted owl (the CASPO Report) which would: analyze and interpret relevant information on owl biology; characterize habitat attributes; evaluate current land management practices; evaluate a range of options to achieve an amount and configuration of suitable habitat to provide for the long-term maintenance of the owl throughout its range; and identify research, inventory and monitoring needs. The PIP Team's charter is to examine and evaluate alternative institutional approaches for implementation of the recommendations of the Technical Team, while minimizing economic, environmental and social costs.

During the time required for the Technical Team to complete its assessment of the status of the California spotted owl, the Forest Service instituted measures to ensure that management options for the owl would be maintained, in view of the doubts cast upon the SOHA strategy. Thus, in July 1991, the Forest Service, in consultation with Dr. Jared Verner (who would become the Technical Team leader) developed a Cumulative Effects Analysis (CEA) process, which was further refined in October 1991. (Refer to Appendix B.) This process is currently being implemented on the Sierran National Forests to evaluate potential impacts of proposed green timber sale projects on suitable owl habitat and ensure that management options for California spotted owl habitat are maintained until the Technical Team completed its report and this assessment is completed. The CASPO Report was released on May 8, 1992 and analysis by the PIP Team is near completion

The Forest Service analysis of the longer-term strategy will begin when the PIP Team issues their recommendations (which is currently scheduled for spring, 1993). In addition, there will be two related future actions after this analysis is completed:

1. Amendment of the Regional Guide and ten Forest Plans for longer-term management of the owl. This action will commence after the decision is issued on these interim guidelines and after and issuance of the PIP Team recommendations. Public involvement in this effort will start with the issuance of a notice of intent to prepare an environmental impact statement. The longer-term amendment will use information obtained from the report of the PIP Team, monitoring results from timber sale and fuel treatment projects that use the CASPO guidelines and additional guidance from the Steering Committee. This longer-term amendment is expected to be in effect until additional California spotted owl research results become available.

2. Amendment of ten Forest Plans to integrate new standards and guidelines for the owl with other provisions of the Forest Plans. These amendments are expected to reallocate land to prescriptions and management areas, modify standards and guidelines for other affected resources, and establish new allowable timber sale quantities in at least seven Forest Plans. The Forest Plan amendment process will be initiated by affected Forests over the next two years.

Proposed Action

The proposed action is to establish interim Regional Standards and Guidelines for timber management activities for protection of the California spotted owl in the Sierran province. Throughout this assessment, the California spotted owl which inhabits the Sierran province will be referred to as "owl." If this document is discussing other subspecies of the spotted owl, or the California spotted owls which inhabit the Southern province, this will be made clear. The Sierran province, as referred to throughout this EA, includes the following ten National Forests: Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus and Tahoe National Forests and the Lake Tahoe Basin Management Unit. All of these administrative units are within Region 5. The Forest Plans for these administrative units may be amended if the Regional Forester selects an action alternative.

The interim standards and guidelines will be in effect until the analysis process is completed and adopted for a longer-term strategy to maintain viability of the owl. It is expected that this process will take approximately two years. The Toiyabe National Forest (Intermountain Region - Region 4) contains small amounts of owl habitat and some owls. The Pacific Southwest Region (Region 5) is coordinating with the Toiyabe, but this decision will not amend that Forest Plan.

Purpose and Need

The Forest Service has a need to manage habitat for the owl on National Forests in accordance with the requirements of the National Forest Management Act (NFMA) and its implementing regulations. The regulations require that wildlife habitat be managed to maintain viable populations of existing native and non-native vertebrate species in the planning area. Refer to 36 CFR 219.19.

Recent studies have demonstrated that current direction does not assure viability for the owl. Both the Conservation Strategy for the Northern Spotted Owl (May 1990) (commonly known as the ISC Report), and the California Spotted Owl Report (May 1992) (CASPO), have concluded that the SOHA strategy for managing spotted owls would likely lead to extinction of the species. The CASPO Report made two additional observations: (1) timber harvest practices have led to a serious decline in the number of large, old trees which are preferred by the owl; and (2) the threat of stand-destroying fires must be considered in any strategy. The purpose of the proposed action is to respond to these studies by developing a management strategy which will maintain population viability for the owl over the short term.

In order to be effective, any short-term strategy must provide for maintenance of management options for the owl. It must therefore include the essential elements for maintenance of viability, as identified in the CASPO Report. While owl viability is the primary objective, the CASPO Report states a desired objective is to maintained spotted owls throughout Sierran conifer forests in a manner compatible with some level of timber production. The specific project objectives are to:

A. Protect known owl nest stands (or main roost stands if nest stands are not known) from any significant modification.

B. Protect very large old trees in those Sierran timber strata which provide suitable owl habitat.

C. Reduce the threat of stand-destroying fires.

It will take approximately two years to complete the environmental analysis to implement a longer-term strategy to maintain viability of the owl. (Refer to the Related and Future Actions portion of this section.) Until that can be accomplished, the Regional Forester is proposing to adopt a short-term strategy for protection and management of spotted owl habitat in the Sierran province in order to bridge the time gap between the current obsolete strategy and whatever longer-term strategy is finally adopted. Because there is a noted and continuing decline of habitat elements essential to the owl, there is a need to implement new Interim Guidelines quickly.

Alternatives and Scope of the Analysis

The alternatives considered, except for the No-Action Alternative, respond to the purpose and need for action and the objectives. The scope of the analysis and the decision to be made are limited. The alternatives and analysis focus on timber and fuel management activities which maintain options for the owl. Cumulative effects are evaluated, however, the primary emphasis is on effects associated with implementing the proposed action over the next two years. While effects on other species or resources are assessed, changes in management of other species or for other resources are not considered. Current Forest Plan Standards and Guidelines would remain in effect for other species and for other resources for the interim period until a longer-term strategy is analyzed and adopted and project-specific analysis can evaluate or mitigate effects to other resources and species.

Any broadening of the alternatives and analysis to include management options for other species or resources would result in the analysis taking years to complete. This would be not be in compliance with the purpose and need for this proposed action which is to quickly get new direction implemented for the benefit and protection of the Sierran province of the California spotted owl.

In particular, the alternatives will address Standards and Guidelines which will direct owl, timber, and fuels management activities. The CASPO Report directed its recommendations to timber activities on public lands. Although there are other activities on National Forests (such as trail or road construction or mining) which can affect forest vegetation and fuels, the current biological evaluation procedures provide an adequate process for evaluating potential effects, and the Forest Service is not proposing to either change these procedures or address non-timber projects in this analysis.

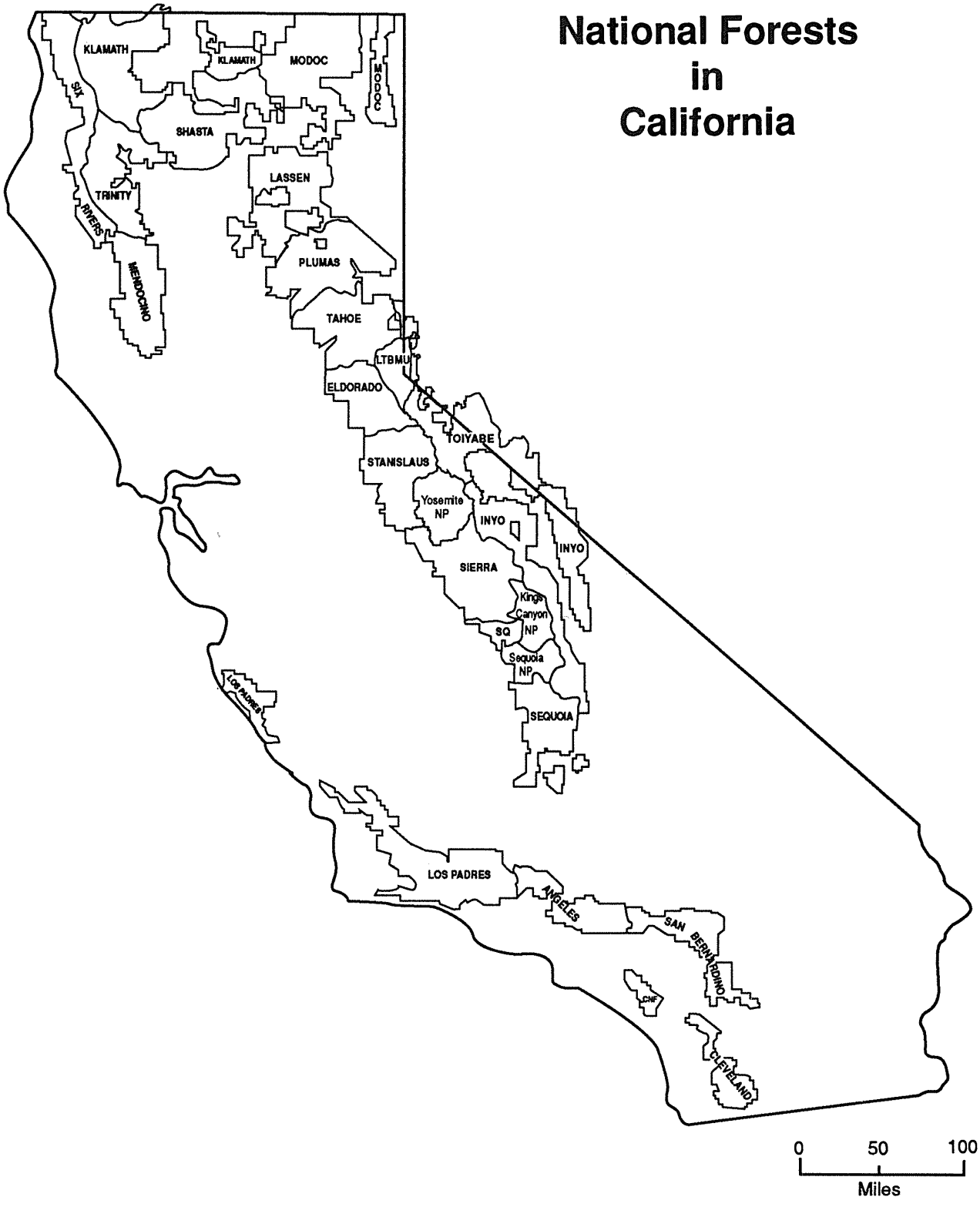
California Spotted Owl Provinces-Analysis Area

The CASPO Report divided the California spotted owl into the Sierran province and the Southern province. Species condition and threats to the habitat of these two provinces were distinctly different. In general, although the Technical Team was uncertain about whether the spotted owl population within the Sierran province was in decline, the Team did find that key habitat elements used by spotted owls have been declining and would continue to decline under Forest Plans. The Technical Team found the Southern province was in decline, however, the Team endorsed the existing management direction on the southern National Forests (Angeles, Cleveland, Los Padres and San Bernadino). Therefore, this Environmental Assessment (EA) will analyze management only within the Sierran province of the California spotted owl. For more details on this subject, refer to the Affected Environment portion of the Wildlife analysis.

In addition, there is little known owl presence (singles or resident pairs) or suitable habitat in the Modoc, Inyo and Lake Tahoe Basin Management Unit, or in pure eastside pine habitat. Refer to the analysis files for information about survey and owl presence results in eastside pine. On the Lake Tahoe Basin Management Unit, there is no regulated timber harvest and on the Inyo National Forest, regulated harvest is limited (and

known owls have not been found within the regulated harvest land base). On the Modoc National Forest, the presence of California spotted owls has not been confirmed.

Because of the very limited amount of habitat on these Forests and in the eastside pine type, and the fact that habitat presence alone is not indicative of owl use on these National Forests, these Forests and eastside pine habitat on other Forests will be addressed only briefly within this analysis. These forests either do no active forest vegetation management where owls exist, or contain only very limited owl habitat. Therefore, the majority of this analysis will focus on the following seven National Forests: Eldorado, Lassen, Plumas, Sequoia, Sierra, Stanislaus, and the Tahoe. Refer to Map 1-Vicinity Map.


National Forests
in
California
KLAMATH
KLAMATH
MODOC
MODOC
SHASTA
LASSEN
TRINITY
RIVERS
MENDOCINO
PLUMAS
TAHOE
LTBMU
ELDORADO
TOIYABE
STANISLAUS
Yosemite
NP
INYO
INYO
SIERRA
Kings
Canyon
NP
SQ
Sequoia
NP
SEQUOIA
LOS PADRES
LOS PADRES
ANGELES
SAN BERNARDINO
CNF
CLEVELAND
0
50
100
Miles

Map 1

SECTION II - ISSUES

SECTION II - ISSUES

Major Issues: The following are the major issues identified through a combination of public involvement and internal discussion. Some of the Major Issues and Other Issues were raised by the public, but are not specifically tracked as such. Refer to the Public Involvement Appendix for information on specific public involvement. Complete comments may be found in the planning records. These major issues are followed by a discussion of key indicators. Key indicators are the primary means by which alternatives will be measured or compared. Some indicators may be appropriate for quantitative measurement, and some may be more appropriate for a narrative discussion. The key indicators are not the only means by which alternatives may vary, but they do display major differences between alternative effects.

A. To what extent will management options for the California spotted owl be maintained in the short term?

B. What are the effects to timber supply and what are economic effects?

C. How will the risk be reduced of fires which would make California spotted owl habitat unsuitable?

Significant Issues and Key Indicators:

A. To what extent will management options for the California spotted owl be maintained in the short term?

Key indicators:

1. Change in the amount and distribution of habitat.
2. Change in the quality of habitat.
3. Length of time required for habitat recovery from logging.
4. Probability and magnitude of habitat-destroying fires.

B. What are the effects to timber supply and what are the economic effects?

Key indicators:

1. Annual volume produced-other effects that are related to volume primarily in direct proportion to effects to volume are related direct effects to employment, indirect secondary effects and effects on imports.
2. Effects to products-in particular the high and low end of the market and related effects.
3. Effects to counties, particularly direct effects to timber-dependent communities. This indicator includes social effects.
4. Effects on timber sale cost efficiency

C. **How can we reduce the risk of fires which eliminate California spotted owl habitat?**

Key indicators:

1. Effects on long-term fuel loading.

2. Effects on fire fighter safety.

3. Effects on fire regime.

Other Issues

D. How will the alternatives affect forest cover?

E. How will the alternatives affect acres of forest silvicultural systems and methods and how will these systems and methods affect key owl habitat components?

F. How will the alternatives affect timber stand insect and disease infestation?

G. How will the alternatives affect other wildlife species, particularly species associated with late-successional forest habitat?

H. How will the alternatives affect watershed, soils and fisheries?

I. How will alternatives affect other resources such as archaeology and recreation? This issue includes related effects to released roadless areas.

Other Issues and Key Indicators

D. **How will the alternatives affect continuous forest cover?**

Key indicator:

Acres of harvests of green trees that produce openings of at least five acres in size. (Dead trees are not considered to provide cover and harvest of dead trees is not considered to affect cover.)

E. **How will the alternatives affect acres of forest silvicultural systems and methods and how will these systems and methods affect key owl habitat components?**

Key indicator:

Acres of particular silvicultural systems and methods.

F. **How will the alternatives affect timber stand insect and disease infestation?**

Key indicators:

1. Acres of silvicultural practices which can achieve appropriate tree density (which can reduce tree susceptibility to insects and disease).

2. Numbers of trees with mistletoe and a stand structure amenable to the spread of infection.

3. Need for multiple entries with an attendant risk for wounding trees.

G. **How will the alternatives affect other wildlife species, particularly species associated with late-successional habitats?**

Key indicators:

1. Acreage in various seral stages, patch size and distribution.
2. Spacing and connectivity of late-successional forest patches.
3. Habitat structural elements provided.
4. Compatibility with management needs for threatened, endangered, and other sensitive species.

H. **How will the alternatives affect watersheds, soils and fisheries?**

Key indicators:

1. Acres entered.
2. Acres of silvicultural prescription.
3. Predictions of new road construction trends.

I. **How will alternatives affect other resources such as archaeology and recreation?**

Key indicators:

1. Archaeology: Acres entered
2. Visual quality: Changes in attainment of visual quality objectives.
3. Recreation and released roadless areas: Indirect effects on road construction (trends).

Issues not specifically tracked, or dismissed from detailed consideration

Some of the following issues, like clearcutting, will be addressed in the EA, but will not be tracked as separate issues. Other issues are dismissed because the alternative strategies are not expected to affect these subjects or resources. Other issues cannot be addressed because they are applicable to a final strategy or to research, and cannot be analyzed within these time frames. Also, some of these "other issues" are addressed in the analysis, but may be a subset of a larger issue, or different terminology may be used. This will be indicated.

- Clearcutting: Acres of clearcutting will change by alternative and this prescription will be tracked in the analysis. Refer to the Silviculture and Continuous Forest Cover "Other Issue."
- Even-aged management: The effects of the alternatives on acres of even versus uneven-aged management will be displayed in the silviculture portion of the Affected Environment/Environmental Effects section of this document.

- Allowable Sale Quantity (ASQ): Commentor requested the ASQ be abolished. The ASQ is based on a decadal ceiling, thus this analysis (which only will be in effect for about a two year period) is not appropriate for considering changes in ASQ levels. Also, eliminating ASQ, which implies that lands were no longer considered suitable for timber management (i.e. there is not a regulated volume goal associated with the land) is appropriate for individual LMP amendment efforts. It is also not necessary to analyze effects on ASQ to meet the analysis objectives or to analyze effects on the owl. The longer-term strategy, which will follow the interim guidelines period, will consider adjusting ASQ levels.

- Costs of stand examinations to implement CASPO: Some commentors thought the cost of examinations to find out exact stand densities and diameter distribution would be high, and could contribute to below-cost timber sales. Some comments also mentioned how increased stand examination cost increases conflicts with Congressional appropriations language that directs the Forest Service to reduce its sale preparation costs by 5 percent. Although specific and detailed sale preparation costs cannot be determined, this subject will be discussed in general terms in the Economics portion of the Affected Environment/Environmental Effects Section.

- Incorporation of qualifiers such as site quality, insect and disease condition, or soil type to more closely fine tune CASPO recommendations. The CASPO Report did not make any differential recommendations for stands of differing site quality or for other features such as fire history, or soil type. Research that would confirm the need for this consideration is not possible within the time frames of this analysis, however, this may be a consideration in Pacific Southwest Forest and Range Research Station (PSW) coordinated research and in the analysis for the longer-term strategy. The Technical Team did alter its recommendations to account for concerns associated with mistletoe infestations. In addition, the CASPO Alternative allows for site specific analysis and analysis of differing recommendations through the biological evaluation process.

- Reforestation: One commentor asked for a change in reforestation techniques. Alternatives considered will change the amount, but not the kinds of reforestation practiced.

- Partial cutting-damage to residual trees on cable ground. This issue will be discussed as part of the silviculture analysis, specifically, refer to the forest health discussions.

- Forest Service programs to reduce clearcutting, ecosystem management and continuous forest cover: Some commentors stated the CASPO Report didn't consider these programs when it criticized the Forest Plan direction. These programs are being implemented in project planning, and the Forest Plans do not always project the effects on outputs. This will be discussed in the Affected Environment/Environmental Effects section of this analysis.

- Harvest sustainability: Harvest sustainability is not a factor for a two year management strategy.

- Multiple species management: Several commentors criticized analysis of just one species and wanted a more comprehensive analysis of other species, particularly old-growth associated species. This is beyond the objectives of this project, but should be considered in the longer-term strategy. The new scientific information (CASPO Report) which initiated this analysis was written to assess the status and needs of the owl. The EA will analyze the general effects of the alternatives on other species. Refer to the wildlife portion of the Affected Environment/Environmental Effects Section of this document. Also, refer to Other Issue #4.

  It is not possible to complete multiple species analysis in the short time frame established to implement interim guidelines for the owl. Due to the conservative approach of both action alternatives and the interim nature of this strategy, it is not expected that the action alternatives would preclude options for management of other wildlife species. Refer to the Affected Environment/Environmental Effects Section and the Biological Evaluation (Appendix C) for more information.

- Multiple entries: Some commentors were concerned that the CASPO recommendation for no more than one commercial entry per five years would unnecessarily limit opportunities to improve owl habitat, or produce economic benefits without degrading owl habitat. The CASPO Report recommended limitations on commercial, not non-commercial entries. Therefore, a commercial timber sale could be followed by a "biomass" sale which would decrease the amount of fuel ladders and decrease the likelihood of stand-destroying fires. Also, it is very unlikely that more than one commercial entry could be planned and executed within a two year interim period. Therefore, this issue will most assuredly be moot for this interim period. Additional consideration should be given during the development of the longer-term strategy analysis. Also, the Technical Team clarified their intent on entries. Generally, both a green and a salvage sale could be implemented and be considered one commercial entry, (Refer to Appendix B).

- Forest fragmentation: The effects of alternatives on fragmentation will be discussed in the Wildlife portion of the Affected Environment/Environmental Effects section of this document. Refer to Other Issue #4.

- Ecosystem management: Both action alternatives can be considered "ecosystem" management in the sense that they look at landscape level management and the interaction of various vegetative and biological elements in the environment. Refer to the multiple species management discussion for related information. Analysis of ecosystem management may be most appropriate for specific Forest Plan-level analyses. The effects of the various owl management strategy alternatives on other resources will be analyzed.

- Biodiversity: The alternatives' effects on other wildlife species and seral stages (including old-growth) will be discussed in the Wildlife portion of the Affected Environment/Environmental Effects section of this document.

- Other projects: Non-timber management projects (which include, but are not limited to such projects as trail or campground construction, mining activities, road construction or special use/ contractural agreements with the public). How to address these projects was originally considered in the May 1992 scoping information. For several reasons, these projects subsequently have been dismissed from this analysis. Foremost, the CASPO Report directed its recommendations to timber management projects (timber sales) due to the extensive effects timber management can have on owl habitat. The Report did not recommend specific changes for management of other projects. Secondly, the Forest Service has procedures in place (Biological Evaluation process) to analyze effects to the owl, propose and analyze mitigation measures, and make viability determinations.

  These other projects are generally small, and often mitigation measures can be implemented that would ameliorate adverse effects to the owls. However, some projects, such as mining or road construction, are location dependent, and full mitigation may not be possible. The concern of the Forest Service for these projects is that affected National Forests consistently use the existing biological evaluation procedure for determining owl effects. This is not a matter for consideration of changing guidelines, but rather a matter of training and implementation in existing procedures. Training scheduled for February 1993 will involve what kind of effects are most likely to be a concern, where effects are most important, potential mitigation measures, and what kinds of projects could trigger a "may affect" determination. Therefore, non-timber projects are dropped from further consideration in this analysis.

- Buffer Yosemite National Park: Yosemite National Park requested a buffer around the park to protect its unique "baseline" values and owls nesting within the park near its boundaries. This is a site-specific policy issue beyond the scope of this analysis. Projects must have a biological evaluation and analysis in accordance with National Environmental Policy Act (NEPA) procedures which considers indirect effects on adjacent lands. The Park's concerns should be raised when specific projects are analyzed in the area of concern.

- Risk assessment-owl: Several commentors, including State agencies, discussed the concept of risk assessment. They were concerned about what they considered a lack of flexibility in the CASPO recommendations and wanted a methodology to deal with the concept of relative risks to the owl. This issue is extremely difficult to deal with as the Technical Team itself could not make a final determination about owl population stability. The CASPO Alternative does allow for adaptive management, which provides opportunities for variation from strict CASPO recommendations under some circumstances. Refer to the Adaptive Management portion of the alternative discussion.

- Risk assessment-environmental factors: One commentor was concerned about activities which could cause a short-term degradation of habitat, when the goal is a long-term benefit. Concern was that climatic, or other major environmental factors could have unforeseen effects. This cautionary approach to unforeseeable adverse events may be appropriate for analysis of the final strategy. However, it is not a major factor to consider for an interim procedure as any projects that would temporarily degrade habitat would likely to be minimal during this short time period.

- Effects on the recession: Economic effects, including effects on counties and employment, are discussed in the Timber portion of the Affected Environment/Environmental Effects section of this document. Any effects on the National recession would be very speculative. Effects on local communities is a more sensitive indicator of economic effects of the alternatives.

- Determine the appropriate fire suppression response in California spotted owl habitat: This was originally identified as a major issue. After discussion, the ID Team decided that this issue is not alternative or owl-driven. In other words, fuels management personnel have been discussing a general change in fire suppression response policy for a number of reasons. Any proposed policy change would be applicable to all alternatives, and any changes would not be initiated by owl protection in particular. However, how the alternatives affect such elements as long-term fuel loading, firefighter safety and fire regime will be discussed in the Fuels and Fire portion of the Affected Environment/Environmental Effects section of this document.

- Funding of fire and fuels: Commentor requested that fire prevention (which involves fuels treatments) be funded in a greater proportion to fire control. This issue will be discussed in the fuels analysis.

- Air pollution: Effects of air pollution on vegetation is beyond the scope of this analysis. However, the relationship of fuels management, (particularly prescribed burning), and wildfire on air quality, will be analyzed. Refer to the Fuels portion of the Affected Environment/Environmental Effects section of this document.

- Effects on mining activities: The alternatives are not expected to change management of minerals and mining on Sierran National Forests. Procedures currently in use for analysis and biological assessments are considered adequate.

- Off Highway Vehicles (OHVs): Alternative strategies will not affect this activity. The CASPO Report made no recommendation about recreation activities within the range of the owl. However, as is stated in the Alternative section of this analysis, all alternatives, including No Action, allow for site specific protection of critical habitat elements (this could include protection from noise disturbance). However, as this is not a change from the existing situation, nor do the action alternatives propose a change, this subject is not addressed in detail.

- Snow mobile use: One commentor was concerned that the alternatives could affect snow mobile use, particularly around owl nest trees. Recreation management will continue to be analyzed on a site-specific basis as effects vary greatly depending upon the type of use and its location. As stated for the OHV issue, all alternatives, including No Action, allow for site specific protection of critical habitat elements (this could include protection from noise disturbance). However, as this is not a change from the existing situation, nor do the action alternatives propose a change, this subject is not addressed in detail.

- Coordination with private land management: Commentor requested that this be done in this analysis. Coordination with multiple land owners is currently being considered by the Steering Committee. The longer-term strategy will consider Steering Committee recommendations. Subject to the California Environmental Quality Act (CEQA), the State has a responsibility to protect wildlife within their regulatory authority. State regulatory agencies have not enacted special rules to protect the California spotted owl. Any special management strategy adopted by federal agencies, in response to the data provided in the CASPO Report, could trigger interest in rule making to protect the owl. However, the CASPO Report does not recommend specific protection measures on state-regulated lands.

  Specific coordination, and joint problem solving can and is occurring at the Forest level for many issues, as exemplified in National Forest timber sale planning within mixed public/private land ownerships. However, detailed analysis of private land management and analysis of effects of a joint strategy throughout the range of the California spotted owl is beyond the scope of this interim guidelines analysis.

- Analysis of intermingled lands: Some State of California commentors wanted the Forest Service to consider the issue of intermingled ownerships when considering owls and owl habitat. Specifically, they asked for flexibility in adoption of the CASPO Report on a Forest basis, and requested increased involvement of the State in decision making. The Forest Service sees merit in this issue, and agrees that the level of analysis necessary to look at coordination between ownerships is best done at the Forest level.

  This will be accomplished when the Forest Plans are analyzed for amendment for longer-term owl management. Public involvement procedures in place under NEPA and NFMA allow the Forest Service to work with other ownerships on analyses of projects and on programmatic planning. However, the State does have a special relationship with the Forest Service and we are currently working to improve coordination between the agencies. The Memorandum Of Understanding for Biodiversity between the State, the Forest Service and other agencies, is an example of this increased commitment for coordination and consideration of joint resource management needs.

- Incorporation of educational efforts within the alternatives: This may be accomplished by the Forests or with coordination from PSW. Alternatives do not preclude this effort.

- Effects on long-term management: This issue will be discussed in general terms throughout this analysis. However, as the scope of this analysis is interim guidelines which will be in effect for only two years, discussion of long-term effects will be limited. Some issues, such as concerns over long-term stand regeneration capabilities, are more appropriate for detailed discussion in the longer-term strategy analysis.

- Adjustment of preferred alternatives for new information: One commentor asked whether information provided by a private timber company that proved managed forests can produce higher densities of owls than unmanaged forests would be considered, and more old-growth not be designated. The Technical Team requested all available information on the California spotted owl and analyzed the information provided. If new, significant scientific information becomes available during the interim guidelines period, it will be considered under appropriate NEPA procedures and interim guidelines could be amended.

- Related non-resource effects to other ownerships: Some public agency commentors, notably representatives of the State of California Board of Forestry, were concerned about the Forest Service proceeding with this analysis when the Policy Implementation Team had not completed their charter to consider economic and social effects of the CASPO Report. Some commentors also questioned the science of CASPO (refer to a following issue). Some felt that the adoption by the Forest Service of a conservative alternative could put undue pressure on other agencies to adopt a similar conservative strategy.

The Forest Service believes that while this pressure will occur, the State, or other federal agencies can reasonably pursue alternative strategies. The majority of owl habitat is on Forest Service system lands, and the CASPO recommendations are designed for public lands only. Refer to the previous discussion of the issue of coordination with private land management. The State has different land management goals and objectives. They may be analyzing long-term (versus short-term) strategies, have different current conditions, and have a different capability of experimenting with alternate strategies. The Forest Service often manages conservatively, which is appropriate for our goals. NFMA requirements for maintenance of viability of species is by necessity a conservative approach towards management of sensitive wildlife species and their habitat. This conservative approach in fact would allow more opportunities on other ownerships rather than restricting them.

The Forest Service continues to coordinate and communicate with the Steering Committee, but does not feel it is necessary to wait for the Policy Implementation Team to complete their work (which will primarily deal with longer-term strategies and alternatives) before proceeding with this short-term analysis. The management strategy that is selected by the Forest Service should not narrow the options for management of other lands. The work of the Policy Implementation Team will be used in the Forest Service analysis for the longer-term strategy developed over the next two years.

- CASPO Report scientific validity: Some commentors questioned the validity of the CASPO Report on a number of perspectives. Some commentors questioned why such restrictive recommendations were made for a species which didn't have a documented downward trend in population or distribution. Many commentors referenced research on private lands. Other commentors questioned whether the Technical Team satisfied their charter, as only one alternative was fully developed and presented as a recommendation. Other commentors specifically questioned technical portions of the Report, for example numbers in tables that didn't appear to match other data. Some commentors felt the CASPO recommendations over-reacted to concerns about owl habitat and others felt the CASPO Report was very risky to owl survival and only the addition of additional "no harvest" areas would guarantee owl viability.

  The reason that the Forest Service felt it necessary to conduct this analysis, and the reason that NFMA standards for viability are applicable, are discussed in the Purpose and Need Section of this document. The CASPO Report represents the best efforts of a highly qualified group of scientists to identify and address concerns associated with the status of the California spotted owl.

  The CASPO Report did receive third-party peer review, which exceeded standard procedures. Standard review procedures call for 3 reviewers, and the CASPO Report was analyzed by 5 reviewers who were independently selected by five professional societies. The review included an adequate statistical analysis. Three of the five reviewers named by these societies had strong mathematical orientation and two were professional quantitative ecologists. A review of the most critical chapters (Chapters 1 and 5) which contained the bulk of the statistics, was conducted by a PSW lead statistician and by a mathematical statistician at the Redding Silvicultural Laboratory.

  The Steering Committee also requested a submittal of significant technical questions that field, research and academic professionals might have regarding the biology and silviculture contained in the CASPO Report. These questions were reviewed and coordinated by the Steering Committee and submitted to the Technical Team. Comments were received from 11 respondents of which, five were scientists or statisticians form the Redding Silvicultural Laboratory. As a result of the comments, some changes were made in the recommendations, although the basic CASPO Report conclusions remained unchanged.

  If pertinent new information arises that could necessitate reanalyzing the CASPO recommendations, NEPA analysis procedures could incorporate and analyze the new information or recommendations. Refer to the previous discussion about adjustment of preferred alternatives for new information.

- Length of interim period: Some people would like the two year interim period to be shorter and some think it should be longer. The interim period is designed as the period the Forest Service thinks it will take to develop a longer-term strategy. Research will be ongoing for longer periods.

- EIS necessity: Some commentors feel an EIS is necessary. This assessment will determine whether an EA is adequate, or whether an EIS will be required for adoption of an interim strategy.

- Time allowed for public comment: Several commentors felt the time allowed for public comment was too short. Every effort was made to inform the public of the analysis at the earliest possible time and to provide them with as much information as possible. The analysis decision was initially desired in September and the Interdisciplinary (ID) Team anticipated the possibility that the analysis would be subject to new appeal regulations which would have required a 30 day public comment period (with 20 days following for Forest Service review of comments). This necessitated a narrowed initial public comment period. However, the proposed appeal regulations were not implemented, and several factors delayed analysis completion and issuance of a decision. The analysis was not completed until December 1992. The Forest Service did accept comments throughout the analysis period.

- Implementation: Commentors varied in when and how they thought a change in management should be implemented. Some wanted CASPO recommendations implemented immediately, and some thought nothing should be changed without further study. How and when this decision will be implemented is discussed in the Decision Notice.

SECTION III - ALTERNATIVES

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ALTERNATIVE 1 - NO ACTION

This alternative proposes continuation of the Spotted Owl Habitat Area (SOHA) network strategy currently in use and analyzed in each of the National Forest's land management plans, as a means of maintaining the viability of the California spotted owl. SOHAs are designated stands of habitat to be managed to maintain suitable owl habitat. Suitable habitat is described as mature timber stands possessing the following characteristics: (1) multi-storied canopies with 70 percent or greater canopy closure; (2) at least 40 percent of the total canopy in trees 21 inches in diameter at breast height (dbh) or greater; and (3) decadence as represented by decay, broken tops, cavities, snags and dead and down material.

Individual SOHAs may occur singly or in clusters of up to three territories, distributed in a network throughout the Sierran province of the owl. The network provides linkages for dispersal and interchange of owls between territories. Direction set forth in the Land Management Plans (LMP) for the Sierran National Forests has resulted in the designation of 264 SOHAs in approved Forest LMPs (Lassen 40, Plumas 54, Tahoe 33, Eldorado 32, Stanislaus 36, Sierra 29 and Sequoia 40). Direction for the other Sierran Forests (Inyo, Modoc, and Lake Tahoe Basin Management Unit) is to protect all known spotted owl sites and to manage the habitat based upon local information about suitability and availability rather than to develop SOHA networks. If a SOHA or portion of a SOHA is rendered unsuitable by a catastrophic event such as a wildfire, Forests may replace that SOHA with the best available option for the network, considering maintenance of owl distribution throughout its range, owl occupancy, habitat suitability and location.

Management direction for SOHAs is to maintain at least 1,000 acres of currently suitable owl habitat within a 1.5-mile radius of the known or potential nest site (this is referred to as "base habitat"). The base habitat consists of a 300-acre nesting core and an additional 700 acres, which includes at least one alternate 300-acre nesting core. To ensure maintenance of at least 1,000 acres of suitable habitat through time, more than 1,000 acres within the 1.5-mile radius must be managed to perpetuate suitable owl habitat. The total acreage to be managed within each SOHA is dependent upon which of three silvicultural management strategies is chosen.

A. For SOHAs which will receive no timber harvest, approximately 1,650 acres would be dedicated. This 1,650 acres includes 1,000 acres of currently suitable habitat, plus 650 acres managed, or allowed to cycle naturally, as replacement habitat. Under this strategy, the implied rotation length is 380 years.

B. For SOHAs managed with even-age silvicultural prescriptions, approximately 2,650 acres would be managed. This 2,650 acres includes 1,000 acres of currently suitable habitat (base habitat), plus 1,650 acres managed for replacement habitat. This strategy implies a rotation length of 240 years.

C. For SOHAs managed utilizing uneven-age silvicultural prescriptions, approximately 2,000 acres would be managed. This 2,000 acres includes 1,000 acres of currently suitable habitat, plus 1,000 acres managed for replacement habitat. This strategy implies a rotation length of 300 years.

D. Owl surveys will continue to be done in accordance with existing survey protocol of March 12, 1991 (issued on April 19, 1991).

For further detail on SOHA management, consult the Regional Guide for the Pacific Southwest Region (40 CFR 1506.4).

ALTERNATIVE 2 - TECHNICAL TEAM RECOMMENDATIONS (CASPO)

This alternative proposes implementation of the recommendations of the California Spotted Owl Technical Team, released as the draft CASPO Report on May 8, 1992, and as a revised draft report on September 15, 1992. A copy of the revised draft may be found in the planning records and at Supervisor's Offices throughout the Region. Alternative 2 is designed to meet the objectives stated in the revised draft CASPO Report, namely to maintain future management options by retaining stand components most at risk and difficult to replace (i.e. very large, old trees throughout Sierran conifer forests) and to protect spotted owl nest/roost stands.

Selection of this alternative would adopt the following as Interim Guidelines for management of the owl for approximately two years on the Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests. Refer to Item E for management of owls and owl habitat on the Inyo and Modoc National Forests and on the Lake Tahoe Basin Management Unit.

Timber strata codes used in these guidelines are defined in the Timber Strata Glossary, Appendix D.

A. Forest-wide

Maintain and manage SOHAs as described in Forest LMPs, with the following exception: For management activities within SOHAs, a SOHA Management Plan is not required if CASPO recommendations for Selected strata (described in Item C) are implemented outside of base habitat (1,000 acres of habitat suitable for nesting, roosting and foraging). Base habitat will not be entered, except for treatments which would follow guidelines for Protected Activity Centers (described in Item B).

If a SOHA or portion of a SOHA is rendered unsuitable by a catastrophic event such as a wildfire, the remaining suitable owl habitat shall be maintained as base habitat. Forests are not required to replace SOHAs or habitat lost to a catastrophic event, however, this may be done. When the character of a SOHA is substantially changed by a catastrophic event, a Biological Evaluation shall be done to determine whether and how the SOHA is managed, the boundary changed, or the SOHA replaced.

B. Known Spotted Owl Sites

Establish a 300-acre Protected Activity Center (PAC) around all known owl sites identified between 1987 and 1992, and described in the California Department of Fish and Game spotted owl database. As discussed in Item G, it is not necessary to survey project sites for this purpose. However, where surveys have not occurred between 1987 and 1992, PACs should be established around older owl sites if the habitat is still suitable. Identify the activity center in each site, defined either by a known nest location or by the best known roost location in the site. The PAC would consist of the best owl habitat available in a 300-acre block: ideally large, well-stocked mixed conifer or pine strata (M5G, M5N, M6, P4G, M4G). (Refer to CASPO Report, Chapter 1 recommendations for more information).

Stand-altering activities should be avoided within the PAC, with the exception of light underburning in these stands, after review and documentation in a BE. Within the PAC, the following guidelines would apply:

> Retain all live trees.
>
> Remove no snags or large culls. For this alternative, snags are defined as dead trees, or trees which will die within 6 months.

If new owl sites are discovered, a Biological Evaluation will evaluate whether a new PAC should be created or substituted to replace one without current use. Creation of a PAC is not required for new owl locations discovered after December 30, 1992.

If creation of a PAC results in a quarter mile buffer around the known owl site, a limited operating period provision in timber sale contracts is not necessary. A limited operating period will only be necessary if this does not occur and timber management activities could occur within this quarter mile zone.

C. **Selected Timber Strata** (This habitat will be referred to as "Selected" strata.)

Outside of the PACs, in strata preferentially selected for nesting by owls (M4G, M4N, M5G, M5N, M6, P4G), the following guidelines would be applied in accordance with the methods described in the CASPO Report. Standards for tree and dead and down retention are to be considered minimums. Snag retention standards are maximums.

Stands may only be entered once for commercial logging.

Remove no live tree 30 inches in dbh or larger.

Retain 40 percent of the basal area, consisting of the largest of the healthy trees and culls in each unit proposed for harvest.

If the largest healthy trees and culls retained in the cut unit do not yield a canopy closure greater than, or equal to 40 percent, make up the difference with stems 12-24 inches in dbh.

Retain the largest snags $\geq$ 30 inches in dbh, to a maximum of 8 snags per acre, which may be averaged over the cut unit or stand. Where this guideline results in less than 20 square feet basal area of snags per acre, retain the largest remaining snags to achieve 20 square feet basal area, to a maximum of 8 snags per acre (whichever comes first). Snags less than 15 inches dbh or less than 20 feet tall do not need to be retained. This standard applies to existing snags and does not require creation of snags.

Girdling (not harvest) of live trees over 30 inches dbh may be done in certain circumstances. If the basal area of snags $\geq$ 30 inches in dbh is less than 20 square feet per acre, a maximum of 10 square feet per acre, or 1 tree per acre if that tree contains > 10 square feet basal area, of live trees may be girdled. These girdled trees may be > 30 inches dbh. The number of these girdled trees may be averaged over the cut unit or stand. This may be done if the biologist and silviculturist agree there are compelling reasons to do so. Refer to the CASPO Report, Chapter 1, for examples of some potential reasons.

Undertake fuel treatments as necessary to remove surface and ladder fuels and protect owl habitat.

Beginning with the largest downed log (by volume), sequentially retain pieces of downed wood until an average of at least 10-15 dry tons per acre are retained. Cull logs created by a timber sale should be left at or near where they fall and included in the tons per acre total. This guideline does not require creation of downed logs. 10-15/Acre

D. **Other Timber Strata** (This strata will be referred to as "Other" strata.)

Outside of PACs, in strata utilized but not preferred for nesting (P3G, P3N, P4P, M2G, M3P, M3G, M3N, M4P, R3P, R3G, R3N, R4G, R4N) the following guidelines would be applied in accordance with the methods described in the CASPO Report recommendations:

Stands may only be entered once for commercial logging.

As in the Selected strata description, standards which retain habitat components may be exceeded as determined by project objectives.:

Remove no live tree 30 inches in dbh or larger.

Retain a minimum of 30 percent of the basal area, consisting of the largest of the healthy trees and culls in each unit proposed for harvest. At least 50 square feet of basal area per acre would be retained.

Retain the largest snags $\geq$ 30 inches in dbh, to a maximum of 8 snags per acre, which may be averaged over the cut unit or stand. Where this guideline results in less than 20 square feet basal area

of snags per acre, retain the largest remaining snags to achieve 20 square feet basal area, or a maximum of 8 snags per acre (whichever comes first). Snags less than 15 inches dbh or less than 20 feet tall do not need to be retained. This standard applies to existing snags, and does not require creation of snags.

Girdling (not harvest) of live trees over 30 inches dbh may be done in certain circumstances. If the basal area of snags $\geq$ 30 inches in dbh is less than 20 square feet per acre, a maximum of 10 square feet per acre, or 1 tree per acre if that tree contains > 10 square feet basal area, of live trees may be girdled. These girdled trees may be > 30 inches dbh. The number of these girdled trees may be averaged over the cut unit or stand. This may be done if the biologist and silviculturist agree there are compelling reasons to do so. Refer to the CASPO Report, Chapter 1, for examples of some potential reasons.

Undertake fuel treatments as necessary to remove surface and ladder fuels and protect owl habitat.

Beginning with the largest downed log (by volume), sequentially retain pieces of downed wood until an average of at least 10-15 dry tons per acre are retained. Cull logs created by a timber sale should be left at or near where they fall, and included in the tons per acre total. This guideline does not require downed log creation.

E. Modoc, Inyo, LTBMU, and Eastside Pine Habitat on Other Forests:

The Modoc and Inyo National Forests, and the LTBMU contribute less than one percent of the known owl sites on National Forest land in the Sierran province. If owls are detected on these Forests, their habitat will be managed in accordance with the Modified CEA Process, described in Alternative 3.

In addition, although no California spotted owls have been found in pure eastside pine types, owls have been found in eastside stands of pine which contain off-site white fir in the understory and/or overstory. On the Lassen, Plumas, and Tahoe National Forests, where suitable habitat is determined to occur within this type, it will be surveyed in accordance with survey protocol of March 12, 1991. If owls are detected, their habitat will be managed in accordance with the Modified CEA Process, described in Alternative 3.

F. Adaptive Management Strategies:

Harvest prescriptions which do not meet these guidelines may be approved by the Regional Forester or the Forest Supervisor in the following situations:

1. A project-specific biological evaluation clearly displays that the intent of the recommendations (i.e. maintain future management options by retaining stand components most at risk and difficult to replace, protect and maintain spotted owl nest/roost stands, and ameliorate excessive fuels build-up) is better achieved through an alternate prescription. This would include proposals such as conducting fuels management activities within PACs or SOHAs where there is high risk of loss of stand integrity because of current fuel conditions, or where owl habitat will not be suitable for many years due to a catastrophic event.

   For example, on the Cleveland Wildfire area (Eldorado National Forest), where dead and down logs were generally completely incinerated, one alternative treatment proposed in some areas to retain approximately half the required snags as standing snags and half which would be felled to provide dead and down material. This proposal meets the intent of the CASPO Report (Refer to Appendix B) and is one example of where a Biological Evaluation may be prepared to document variance from CASPO recommendations.

2. The project is designed as an administrative study (refer to FSM 1991) to help answer questions regarding the effects of various silvicultural systems on owl habitat, particularly those systems with a high probability of providing target stand structures for suitable habitat (refer to Chapter 2 and Chapter 13 of the CASPO Report for more details). Projects must be coordinated with PSW, or with an oversight

team established for this purpose. As with all administrative studies, a formal Study Plan (FSM 1991.1.b) approved by research scientists, is required.

Goals and objectives of such studies will be established in coordination with research scientists or an established oversight team. On each National Forest, administrative studies should be limited to no more than two percent of the lands identified as "suitable for timber production" in the Forest Land Management Plan. Any exceptions must be based upon an established scientific need discussed in a biological evaluation. These administrative studies may be designed to test alternatives proposed by the Policy Implementation Team.

G. Owl Survey Protocol

Under this alternative, owl surveys would not be necessary prior to project approval for projects implementing the CASPO guidelines, except for suitable habitat within the eastside pine type. The owl is presently widely and evenly distributed throughout the mixed-conifer zone, the lower red fir type, and much of the ponderosa pine/hardwood type, and the requirements of this alternative ensure that important habitat elements are retained in these habitat types. Further inventory would only be required in association with research, study and monitoring operations or for projects that do not follow CASPO guidelines.

H. Monitoring

Forests will need to develop a monitoring strategy in coordination with PSW and the Regional Office wildlife and fire staffs to collect information on implementation of these guidelines that will assist in development of a longer-term strategy for management of the owl. This monitoring strategy should include, but is not limited to:

Collection of fire history data in a digital format so that analysis can be completed on the long-term effects of wildfire on the distribution of owls. This data will also support quantification of the length of time that large wildfires make forested areas unsuitable as owl habitat.

Collection of data on the effects of large fires on PACs to determine the direct effects of fire on duff, down woody fuel loading, canopy closure and other attributes of owl habitat. This information should be maintained in a database to determine what effects the occurrence of the fires has on owl behavior, reproduction, nesting and foraging.

Determination of the rates of fall of various sizes and classes of snags, and the rates of decomposition of various sizes of down material, differentiated by aspect if appropriate.

The Technical Team has requested that validation of strata typing be documented for timber sale projects. The Forests are required to keep records of the following which should be updated on a six months basis.

In stands which are ground-inventoried for a timber sale analysis, records shall be kept of any changes to the strata designation of the stand from the original forest inventory. This will require tracking of stands analyzed in each alternative.

ALTERNATIVE 3 - CUMULATIVE EFFECTS ANALYSIS (CEA) PROCESS

This alternative proposes continued use of the cumulative effects analysis (CEA) process used by the Sierran National Forests since July 1991, with modifications made to incorporate new information presented in the CASPO Report. The process is described in more detail in Appendix B, along with an explanation of the changes that have been made for this alternative.

The CEA process is intended to maintain a full range of options for managing spotted owls in the future by maintaining habitat needed to support the existing owl population. It is a project-driven analysis process, which evaluates the potential effects of a proposed project upon spotted owls. Necessary adjustments are made to projects to ensure that the proposed action will not reduce or degrade the total suitable owl habitat below levels needed to support the current estimated number of owls in the analysis area.

The CEA process will generally result in no timber harvest within suitable spotted owl habitat, except where the proposed action is outside an identified or predicted owl use area and beyond the needs of adjacent owls, or where the owl use area has habitat surplus to the needs of the owl. Selection of this alternative would adopt the following as Interim Guidelines for management of the range of the owl for approximately two years:

A. SOHA Management

Maintain the SOHAs identified in Forest LMPs, and SOHAs shall be managed as specified in the Forest LMPs.

> If a SOHA or portion of a SOHA is rendered unsuitable by a catastrophic event such as a wildfire, the remaining suitable owl habitat shall be maintained as base habitat. Forests are not required to replace SOHAs or habitat lost to a catastrophic event, however, this may be done. When the character of a SOHA is substantially changed by a catastrophic event, a Biological Evaluation shall be done whether the SOHA is managed, the boundary changed, or the SOHA replaced.

B. PAC Identification

Identify of activity centers for all known and probable pairs or resident single spotted owls, that could be directly or indirectly affected by the project (directly affected sites are those in which project activities will occur; indirectly affected sites are those which adjoin directly affected sites and adjoining owls are expected to share habitat). Establish a 300-acre PAC around all known owl sites.

C. Analysis Area Identification

Develop an analysis area that generally corresponds to the combined use areas of the known and probable owls determined to be directly or indirectly affected by the project (refer to Item E).

D. Habitat Mapping

Map all suitable nesting and foraging habitat available within the analysis area, using the most current information. Habitat is mapped based primarily on the attributes of canopy closure, dominant overstory trees, and multi-storied structure. In general, the following definitions are used:

> On the west side of the Sierra Nevada range, nesting habitat occurs within stands with greater than 70 percent crown closure, over half of which is in dominant, overstory trees. Foraging habitat occurs in stands with 40 percent or greater crown closure, which includes all trees greater than 20-30 feet tall (both overstory and understory). Vegetation below 20 feet should be open enough to allow flying space to attack prey.
>
> On the east side of the Sierra Nevada, habitat includes pine stands with off-site white fir in the understory and/or overstory. Nesting habitat includes stands with 70 percent or greater canopy cover and foraging habitat includes stands with 40 percent or greater canopy cover.

Forests may supplement these definitions for the eastside as necessary, through implementation and monitoring.

E. Owl Use Area Mapping

Mapping of owl use areas for all known and probable owls based upon location and amount of suitable habitat, topographic features, knowledge of average home range sizes, and adjacent owl locations. Use area sizes among California spotted owls are extremely variable; average size of breeding season use areas for individual birds in the true fir type was approximately 7,000 acres; in the mixed conifer type approximately 4,200 acres; and in the oak woodland type, about 1,000 acres.

F. Remaining Habitat Calculation

Calculate the amount of nesting and foraging habitat that will remain in each owl use area after completion of the project, and also following completion of future projects with signed decision notices or developed harvest plans on private lands.

G. Project Adjustment

Adjustments are made to the project so that the proposed action will not reduce the total suitable owl habitat below levels needed to support the current estimated number of owls in the analysis area. If the project would not reduce the amount of nesting or foraging habitat below amounts needed in each owl use area, or if the project would not reduce existing amounts of suitable habitat in any owl use area, it may proceed as planned.

The amount of suitable habitat needed to support the current estimated number of owls in the analysis area is determined using the best available information from local research. The CASPO Report indicates that the amount of habitat used by owls is variable, but is smallest in habitat at relatively low elevations dominated by hardwoods, intermediate in size in conifer forests in the central Sierra Nevada, and largest in true fir forests in the northern Sierra Nevada.

The average amount of habitat (canopy closure $\geq$40 percent) used during the breeding season in the mixed conifer zone is 2,550 acres, about 450 acres of which is suitable for nesting; in the true fir zone is 6,840 acres, about 3,740 acres of which is suitable for nesting; and in oak woodland habitats is 780 acres, about 140 acres of which is suitable for nesting. These acreage figures include habitat where use may overlap between neighboring pairs (Appendix B).

H. Additional Requirements to Maintain Options

Based on information in the CASPO Report, the following additional requirements would be added in order to maintain management options:

1. No harvest of live trees would occur within PACs which are defined as a 300 acre contiguous block of the best available suitable habitat surrounding spotted owl pair or resident single locations, unless designed to improve or enhance the desired habitat attributes for the spotted owl. The following factors would be assessed when determining best available habitat: vegetation type, stand size, canopy cover, number of tree layers, average diameter, extent of fragmentation, etc.

   If creation of a PAC results in a quarter mile buffer around the known owl site, a limited operating period provision in timber sale contracts is not necessary. A limited operating period will only be necessary if this does not occur and timber management activities could occur within this quarter mile zone.

2. Within Selected and Other strata (Refer to the Glossary, Appendix A) remove no live tree $\geq$30 inches dbh and retain at least 30 percent of the basal area (or 50 square feet of basal area, whichever is greater) in the largest healthy trees and culls.

3. Within all suitable and potentially suitable owl habitat, outside of PACs, save the largest snags $\geq$ 30 inches dbh, to a maximum of eight snags per acre, which may be averaged over the cut unit or stand. If this guideline results in less than 20 square feet basal area of snags per acre, retain the next largest snags until 20 square feet basal area is achieved or to eight snags per acre (whichever comes first). Snags < 15 inches dbh or less than 20 feet tall do not need to be retained. This standard applies to existing snags, and does not require creation of snags. For this alternative, snags are defined as dead trees, or trees which will die within 6 months.

4. Girdling (not harvest) of live trees over 30 inches dbh may be done in certain circumstances. If the basal area of snags $\geq$ 30 inches in dbh is less than 20 square feet per acre, a maximum of 10 square feet per acre, or 1 tree per acre if that tree contains > 10 square feet basal area, of live trees may be girdled. These girdled trees may be > 30 inches dbh. The number of these girdled trees may be averaged over the cut unit or stand. This may be done if the biologist and silviculturist agree there are compelling reasons to do so. Refer to the CASPO Report, Chapter 1, for examples of some potential reasons.

5. Within all suitable and potentially suitable owl habitat, beginning with the largest downed log (by volume), sequentially retain pieces of downed wood until an average of at least 10-15 dry tons per acre are retained. Cull logs created by a timber sale should be left at or near where they fall, and included in the tons per acre total. This guideline does not require downed log creation.

I. Modoc, Inyo, LTBMU, and Eastside pine habitat on other Forests:

The Modoc and Inyo National Forests, and the LTBMU contribute less than one percent of the known owl sites on National Forest land in the Sierran province. Only if owls are detected on these Forests, will their habitat be managed in accordance with the Modified CEA Process, described in this alternative.

In addition, although no California spotted owls have been found in pure eastside pine types, owls have been found in eastside stands of pine which contain off-site white fir in the understory and/or overstory. On the Lassen, Plumas, and Tahoe National Forests, where suitable habitat is determined to occur within this type, it will be surveyed in accordance with existing survey protocol of March 12, 1991. If owls are detected, their habitat will be managed in accordance with the Modified CEA Process, described in this alternative.

J. Owl Survey Protocol

Under this alternative, owl surveys prior to project approvals which follow the CASPO guidelines, would not be necessary except for suitable habitat within the eastside pine type. The owl is presently widely and evenly distributed throughout the mixed-conifer zone, the lower red fir type, and much of the ponderosa pine/ hardwood type, and the requirements of this Alternative ensure that important habitat elements are retained in these habitat types. Further inventory would only be required in association with research, study and monitoring operations.

K. Monitoring

Forests will need to develop a monitoring strategy in coordination with PSW and the Regional Office wildlife and fire staffs to collect information on implementation of these guidelines that will assist in development of a longer-term strategy for management of the owl. This monitoring strategy should include, but is not limited to:

Collection of fire history data in a digital format so that analysis can be completed on the long-term effects of wildfire on the distribution of owls. These data will also support quantification of the length of time that large wildfires make forested areas unsuitable as owl habitat.

Collection of data on the effects of large fires on PACs to determine the direct effects of fire on duff, down woody fuel loading, canopy closure and other attributes of owl habitat. This information should be maintained in a database to determine what effects the occurrence of the fires have on owl behavior, reproduction, nesting, and foraging.

Determination of the rates of fall of various sizes and classes of snags, and the rates of decomposition of various sizes of down material, differentiated by aspect if appropriate.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

The following alternatives were considered, but were not analyzed in detail.

A. **Habitat Conservation Areas:** Some members of the public requested that an alternative be considered that analyzed Habitat Conservation Areas (HCAs) for the California spotted owl. An HCA is a contiguous block of habitat to be managed and conserved for breeding pairs, with multiple HCAs spaced to assure connectivity and distribution of spotted owls. Unless experimentation has shown that a silvicultural treatment will facilitate the development of suitable habitat, timber harvest is not allowed. Also, salvage, and firewood cutting is not allowed except in very prescribed circumstances. Refer to the ISC Report, Appendix Q.

This system of management was first proposed by the Interagency Scientific Committee (Thomas et al. 1990) for management of the northern spotted owl. The CASPO Report (Chapter 1, p. 31-35) discussed this alternative and did not recommend it for reasons summarized as follows: there is inconclusive evidence of decline of the Sierran population of the California spotted owl; there is evidence that forest stands in the Sierra can remain spotted owl habitat when partially cut, (as partial cuts were not common in the range of the northern spotted owl, this evidence did not exist); the number of spotted owl pairs that would likely be maintained within an HCA system would be small enough to introduce substantial risks associated with catastrophic events, such as stand-destroying fires in HCAs; fire is a major threat in the range of the Sierran population of the California spotted owl, and the CASPO Report indicated that it is unlikely that funds would be available to manage the fuels in HCAs where logging was excluded. Given these considerations, the CASPO Report concluded that an HCA strategy for the Sierra Nevada has as many faults as it has benefits.

The CASPO Report discussed in general terms the kinds of areas where HCAs would be created and the numbers of owls these HCAs might support. The Technical Team considered four different versions of the HCA concept, which varied in numbers of owls protected, location of HCAs, and management of stands between HCAs. These versions were not analyzed completely, although a series of overlays was developed on one-inch-to-the-mile maps (personal communication with Gordon Gould). Because these alternatives would not adequately provide for protection from stand-destroying wildfires, and because the Technical Team provided substantial reasons for dismissing this alternative for an interim period of at least the next five years, it was not necessary to analyze it in detail for this analysis. In addition, refer to Appendix B - Technical Team response to questions, for further information on this topic.

B. **Establishment of a 4,500 acre protected activity center around owl locations.** This strategy was considered by the Technical Team (personal communication with Dr. Jared Verner). It would result in overlapping circles between neighboring owl sites. This alternative was dismissed from detailed consideration because it would be similar to the alternative that eliminated harvest in suitable and potential owl habitats, it would not allow for fuels treatment, and it shared many of the disadvantages discussed for the HCA Alternative, primarily that it would not adequately provide for protection from stand-destroying wildfires.

C. **Current CEA process.** The ID Team initially considered fully developing two CEA alternatives. One CEA alternative was the CEA procedure currently in use, and the other was an alternative modified to respond to the recommendations in the CASPO Report. After further consideration, it was apparent that the current CEA process, while for the most part protected existing spotted owl habitat, did not fully meet the analysis objective to maintain options to manage the Sierra population of the California spotted owl. The current CEA process does not assure retention of the very large, old trees, which is an analysis objective. The CEA process was designed to be updated to incorporate new information. This was accomplished through the development of the Modified CEA Alternative which assures that future management options are maintained. Refer to Appendix B for discussion of the current CEA process, and changes made in the Modified CEA Alternative (Alternative 3).

D. **Moratorium on timber harvest within owl habitat.** This alternative was dismissed from detailed consideration because it would have the same disadvantage described for the HCA alternative in that it would not provide a means for reducing the risk of stand-destroying wildfire.

E. **Moratorium on timber harvest within Selected strata only.** Several commentors suggested this modification of harvest moratorium. Forest Plan direction could continue, except on Selected strata, which would have no harvest (one commentor suggested fuels reduction which would harvest some trees might be acceptable). This alternative was dismissed from detailed consideration because it would not meet the objectives of reducing the risk of stand-destroying wildfire within the Selected strata, and would not maintain the very large, old trees or the known owl nest stands outside of the Selected strata.

F. **Moratorium on timber harvest in all Sierran National Forests.** This alternative was dismissed from detailed consideration because prohibiting timber harvest on all lands would not respond to the analysis objective maintaining spotted owls throughout Sierran conifer forests in a manner compatible with some level of timber production. It also had the same disadvantages as the HCA Alternative (and others) in that it would not reduce the threat of stand-destroying wildfires.

G. **CASPO, except Moratorium on timber harvest in Selected strata.** One commentor suggested CASPO recommendations be modified to prohibit harvest in Selected timber strata. The reasoning was that CASPO acknowledged incomplete inventory of the owl. This alternative was dismissed from detailed consideration because it failed to reduce the threat of stand-destroying fires within Selected strata.

H. **Old-growth preservation network/riparian network-timber harvest moratorium.** Some commentors requested that an alternative be developed that provided a network of old-growth habitat and movement corridors centered around riparian systems. Such an alternative might be appropriate in considering landscape level approaches for management of late seral stage ecosystems and species, but it does not directly address the objectives outlined in the CASPO Report for interim measures to maintain the California spotted owl. Habitat elements of old-growth, or riparian areas that are important to owls (such as retention of large trees, maintaining a relatively high basal area, and retention of adequate dead and down material) are elements of the developed alternatives.

   This type of alternative may be an appropriate consideration for development of a longer-term management strategy for the California spotted owl and other mature forest species. It was dismissed from detailed analysis in these interim guidelines because it did not specifically address the objectives of protecting existing owl nest and roost stands, retaining the large, old trees, nor did it address the concern of reducing stand-destroying wildfires in owl habitat.

I. **CASPO or management specifically for the owl only in "problem areas."** As most areas appear to be supporting an adequate density of owls, some commentors questioned why management alternatives were not just directed to areas with a current inability or problem supporting owls. Areas such as bottleneck areas, gaps, areas of low density and areas of local isolation (more commonly on the periphery of the Sierra province) were mentioned. The CASPO Report describes concerns for current and future California spotted owl populations based on habitat condition and future habitat trends throughout the Sierra Nevada. The Report acknowledges that despite their current distribution, owl population trends remain inconclusive. For these reasons, any alternative developed for this interim period should not foreclose options for whatever longer-term management strategy may be adopted, and must therefore retain the current distribution of owls. An alternative which does not address habitat concerns throughout the Sierran province, would not ensure that future management options are maintained. A conservative strategy for a 2 year interim period would not preclude concentrating future management in problem areas.

J. **Alternative designed to mitigate timber supply and economic effects.** The ID Team considered several potential approaches to this alternative.

1 The ID Team considered developing specific areas where CASPO recommendations would be applied, and other areas where the Forest Plan Standards and Guidelines would be applied. This alternative was dismissed from detailed consideration as it did not meet the analysis objective of protecting known owl nest stands and very large, old trees outside of the "CASPO" zones. This alternative would not maintain the current distribution of spotted owls, would increase nearest-neighbor distances, and would result in greater concerns regarding successful dispersal. In addition, this system would tend to "zone" the forest and encourage more harvests outside the CASPO areas, which would defeat one purpose of the CASPO recommendation (it would be less likely fuel treatments would be accomplished within CASPO areas).

2. The ID Team considered applying CASPO recommendations to Selected strata only. Forest Plan guidelines would apply on "Other" strata and on non-suitable strata. This alternative was dismissed from detailed consideration as it did not meet the analysis objectives of protecting known owl nest stands and very large, old trees outside of the Selected strata areas. Considerable time could be required to replace important habitat elements, such as large trees and snags, within these Other and non-suitable strata. The ID Team did consider special circumstances where habitat manipulation which was not in compliance with CASPO recommendations might be desirable. These situations would probably more often occur in the "Other" strata (utilized spotted owl habitat, but not Selected). However, the CASPO Alternative allows for habitat manipulation that is not in compliance with CASPO recommendations when a Biological Evaluation identifies site-specific strategies that would better meet the intent of the recommendations in the CASPO Report. (Refer to the Adaptive Management portion of the alternative description.) Therefore, the ID Team felt the positive aspects of this alternative could be incorporated into an existing alternative.

3. Adjustment of the diameter limit or basal area recommendations of the CASPO Report to allow harvest of some larger trees and more flexibility in silvicultural treatments. This alternative was dismissed from detailed consideration as there was no current research which would support these alternatives. In addition, Alternative 2 provides for silvicultural flexibility in the Adaptive Management guidelines. Consideration of specific adjustments may be appropriate for analysis in a longer-term strategy.

4. No clearcutting alternative. A large segment of the public objects to clearcutting, and an alternative that eliminated clearcutting method was suggested. Although this alternative could indirectly provide some habitat features that the owls need, it was dismissed from detailed consideration as it did not meet the analysis objectives of ensuring the protection of very large old trees, and known owl nest stands. In other words, "no clearcutting" would not prevent harvest of very large, old trees, nor would it necessarily protect nest stands because other harvest methods could be used in known nest stands.

   The CASPO Report considered several uneven-aged silvicultural systems and concluded that these systems were appropriate to consider as a longer-term approach once additional information is available on the responses of owls to various treatments. The Modified CEA and CASPO Alternatives do result in a marked reduction of clearcutting within owl habitat.

5. Uneven-aged management or "classical" group selection alternative. This alternative is similar in some respects to the previous alternative. It would indirectly provide some habitat elements that owls need. However, it also did not ensure protection for the very large, old trees and snags, nor does it guarantee protection of known owl nest stands. This alternative was dismissed from detailed consideration for those reasons, but it could be considered in the longer-term analysis.

6. Modified group selection alternative. If group selection were modified to protect some or all of the very large old trees and snags and was modified to protect known nest stands, it could potentially meet long-term owl needs. The amount of very large trees and snags retained and how nest stands would be protected needs to be researched. This alternative is appropriately

considered in the longer-term analysis, and/or it may be tested initially as part of the Adaptive Management portion in the CASPO Alternative.

7. CASPO recommendations modified to allow group selection harvests to start to mimic historically natural regeneration patterns and thinnings with the purpose of creation of stand structure. These silvicultural treatments (and other modifications of traditional silvicultural methods) were discussed in Chapter 13 of the CASPO Report as potential ways to initiate long-term management of Sierran stands.

   The ID Team saw merit in research and experimentation of silvicultural systems not specifically recommended by the CASPO Report, but felt this research should be coordinated between the Forests, the Regional Office and PSW. This experimentation is encouraged in the CASPO Alternative, (Refer to the Adaptive Management portion of the alternative description) but is not developed in detail as a separate alternative. In addition, this alternative does not respond to stated objectives of the analysis to protect known owl nest stands from significant modification and to protect very large old trees. This alternative is not appropriate for consideration on a Regional scale.

8. Alternative designed to mimic natural fire patterns. The State suggested an alternative be developed which mimicked the pattern of fires in the Sierra. This alternative would allow selective harvest with small group selection cutting to create smaller openings. Silviculturists would test or model the sensitivity of the vegetation mosaic to different rates of harvest overtime using sustainable group succession management. The densities of harvests and stand regeneration could be varied, studied and monitored to get information over time and over the landscape.

   As stated previously, The ID Team saw merit in research and experimentation of silvicultural systems not specifically recommended by the CASPO Report, but felt this research should be coordinated between the Forests, the Regional Office and PSW. This experimentation is encouraged in the CASPO Alternative, (Refer to the Adaptive Management portion of the alternative description) but is not developed in detail as a separate alternative. In addition, this alternative does not respond to stated objectives of the analysis to protect known owl nest stands and to protect very large, old trees. Therefore, this alternative is not appropriate for consideration on Regional scale.

9. Modify CASPO and other alternatives to allow harvest in SOHAs. This modification was considered because the CASPO Report, although recommending maintaining SOHAs, states that "we cannot anticipate what role they may play, if any, in a long-term strategy." This alternative was eliminated since it would not meet the objective of maintaining management options. The role SOHAs may play in the future will be considered in the longer-term analysis which will follow the completion of the Interim Guidelines analysis. Further research will probably be necessary to make a determination regarding the importance of SOHAs to a longer-term strategy. However, the action alternatives have clarified SOHA management, and the CASPO Alternative does allow management outside of base habitat. Both action alternatives have also clarified SOHA management if habitat is rendered unsuitable (for example, as a result of a wildfire).

K. **California Forestry Association (CFA) Alternative** (the complete proposal is available in the analysis files). The objectives of this alternative were as follows: Manage all contiguous watersheds (approximately 5,000 acres) to have sufficient acreage by seral stage to support a breeding pair of owls; Maintain the habitat capability of landscapes currently supporting pairs of spotted owls; Develop and implement plans to increase the habitat capability of landscapes that do not currently support spotted owls. The primary rationale behind this alternative was that if one surveyed the habitat conditions around nest sites of successfully breeding owls, a template could be made that could produce appropriate percentages of seral stages the birds need. One to four potential nest sites per watershed, with 25 to 100 acres of habitat retained around each nest site, was prescribed.

The research conducted, and the recommendations provided had the goal of providing the minimum amount of habitat for successful owl breeding, on the theory that owl populations increase with increasing habitat and then level off. CFA's approach is to manage the point where the owl population curve flattens, i.e. where increasing amounts of habitat do not result in an increase in owl population.

The ID Team thought that portions of this general management theory may have merit, but that data was currently unavailable to support most aspects of this approach. Available data did not support the nest acreage figures (which were much lower than CASPO recommendations) or the theory that reproducing conditions of surrounding habitat that owls were currently using would maintain options for owls. To provide one example of the uncertainties of such an approach, data collected on a breeding pair for one year (or even two or three years) would not inform us whether reproduction was occurring at an adequate rate, or whether reproduction in that habitat had actually declined from successful breeding every year, to successful breeding once every five years.

To maintain California spotted owls, CFA's proposal would have to ensure that management prescriptions would retain the amount and spatial pattern of habitat that will provide for a long-term balance between owl birth and death rates. Available information is insufficient to allow this conclusion to be reached. Because the information needed to implement such an approach has yet to be collected, this is not an appropriate strategy for interim guidelines proposed for one or two years. This approach may be appropriate to consider for development of longer-term guidelines.

L. **Adaptive management strategy.** One commentor favored this concept where the Forest would define desired future condition (DFC) by watershed, and this condition would be based on CASPO Report recommendations. These DFCs would vary by vegetation types, but specific vegetation characteristics might be similar. There could also be variation by geographic location. Once DFC is defined, biologists and silviculturists and others would design project level activities to lead toward the DFC. This may involve one or more entries. A monitoring plan would be required, and the commentor suggested an oversight interagency/public team might be desired to review projects or representative samples of projects.

The ID Team believes this concept has merit. However, during an interim period of two years, it is doubtful that a Forest could develop such a plan for a large number of projects. This concept might be tried on one or two watersheds per Forest during the interim period. It has been incorporated into the CASPO Alternative Adaptive Management guidelines, although the DFC concept, and the concept of limited experimentation by watershed, is not specifically described. The manner in which Forests propose adaptive management strategies would be determined on a site-specific basis, with PSW involvement.

M. **Alternative approach to management of "Selected strata":** This alternative was proposed in Chapter 13 of the CASPO Report (pages 11-12) as an alternative approach for the interim management of the Selected strata. This alternative approach is dismissed from further consideration because the effects of this proposal relative to owl viability is essentially the same as the CASPO Alternative. Therefore, this alternative contributes nothing meaningful to the range of alternatives presented. In addition, this alternative further reduces timber available for harvest, would be much more difficult to implement because of the amount of stand inventory data required and silvicultural prescriptions would be much more cumbersome to design.

N. **Salvage options not developed in detail:**

1. Snag recruitment. In the past two years there has been a very rapid increase in drought-induced insect mortality. Some Forest Service employees supported the concept of salvage harvest in excess of snag retention guidelines where there was a reasonable prediction that additional trees would die and become snags. This procedural concept

may have merit in certain circumstances. For example, in very dense ponderosa pine stands, with a high number of trees over 30 inches dbh, and severe bark beetle infestation, it may be possible to reasonably predict continued mortality in large trees (which are the most desirable for the owl). However, it is not possible to fully develop this alternative at the Regional level.

Forests may develop this concept either on a Forest, District or project level, with specific local information provided by silviculturists, pathologists, entomologists, wildlife biologists and other specialists. Effects to the owl would have to be evaluated in an environmental document, at the project level, and at the programmatic level, if a programmatic document is prepared. The Region has developed a general concept paper (which is in the project files) that may be useful to the Forests to provide general principles.

2. Snag retention levels based upon current fire danger. There is a strong public perception that high levels of snag retention contribute to current danger of wildfire and these publics would like snag retention limited on that basis. In fact, standing snags do not contribute directly to the intensity of wildfire. Snags are important sources and receptors of spot fires, which spread fires across roads, rivers and other barriers. Spot fires increase wildfire suppression costs and cause safety problems. Snags are very hazardous to fire fighters.

   Snags decrease fire fighting efficiency because they must either be removed or avoided while constructing fireline. In the long term, snags deteriorate, fall and are added to the fuel load. The levels of snags required under Alternatives 2 and 3 will result in fuel loadings which may exceed the required 10-15 tons per acre minimums in some areas. It is not possible to predict how often this will occur, however, due to the tree mortality effects of the drought, it is likely this could occur on a relatively high percentage of acres treated.

   The fuel and snag requirements in the CASPO Report were based on fuel loading data from areas where fire has been excluded and fuels had accumulated for at least 60 years. The implementation of the requirements coincides with widespread drought-induced mortality throughout the Sierra. It is unlikely that fuel and snag levels were maintained at these levels in a natural forest with a frequent fire regime. Clearly, the snag and fuel requirements will contribute to future fire problems. However, there is no data to link lower fuel levels with survival of self-sustaining owl populations. Until such studies can be conducted, this option cannot be considered.

   Monitoring to acquire this information has been included as part of Alternatives 2 and 3.

3. Separation of snag guidelines in areas with drought-induced mortality from areas which had experiences large wildfires. Consideration was given to buffering the exterior of these wildfire ares with areas of higher snag levels to provide snags near to suitable owl habitat, and having lower snag levels in the interior of fire areas where long-term provision of dead and down material was the primary goal. This alternative was dismissed from detailed consideration because the amount of snags needed to provide for owl habitat in these situations was too variable to incorporate into Regional guidelines. However, the Adaptive Management portion of Alternative 2 does allow for site-specific variance from snag guidelines if owl benefits can be provided by an alternative strategy.

SECTION IV - AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

SECTION IV - AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

Incomplete or Unavailable Information

There is less than complete knowledge about many of the relationships and conditions of spotted owls, the forest, jobs, and communities. The ecology, inventory and management of a forest and the related effects to communities is a complex and developing science. The biology of the spotted owl prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities cannot be determined exactly.

The Interdisciplinary (ID) Team estimated the effects of the alternatives by using existing data and established relationships. There is a substantial amount of credible information about the topics of this analysis, and the basic data and the central relationships are well established.

When encountering a gap in information, the ID Team posed the question implicit in the Council on Environmental Quality (CEQ) Regulations on incomplete or unavailable information: Is this information "essential to a reasoned choice among alternatives"? (40 CFR 1502.22(a)). The ID Team concluded that the missing information would frequently add precision to estimates or better specify a relationship. However, the basic data and central relationships are sufficiently well established in the respective sciences. Therefore, new information is very unlikely to reverse or nullify understood relationships. New information would be welcome, and would add precision, but it was not essential to a reasoned choice among the alternatives as they are constituted.

Cumulative Effects

"Cumulative effects" result from the incremental impact of individually minor but collectively important effects taking place over a period of time. Virtually all of the environmental consequences disclosed in this environmental assessment are "cumulative effects" as they are the environmental and management impacts of an accumulation of management actions which will occur locally throughout the range of the Sierran province of the California spotted owl (owl).

The existing condition of the vegetation as it relates to spotted owl biology and other wildlife species will be discussed in the Wildlife portion of this section. The existing condition of the vegetation as it relates to the timber program and stand health will be discussed in the Timber portion of this section. The existing condition of vegetation as it relates to fuels and wildfire management will be discussed in the Fuels portion of this section. Some resources, particularly dead and dying trees, will be discussed in more than one section. Archaeology and the watershed resource will be discussed under the "Other Resources" portion of this section, with appropriate subheadings. The following discussion will concentrate on the identified issues and key indicators. These issues and key indicators listed in the Issues section of this document will be repeated for increased readability.

CALIFORNIA SPOTTED OWL

Issue: **How well will management options for the California spotted owl be maintained in the short term?**

****Key Indicators:** **(1) Changes in the amount and distribution of suitable habitat; (2) Changes in the quality of habitat; (3) Length of time required for habitat recovery following harvest; (4) Probability and magnitude of habitat destroying wildfires**

Affected Environment

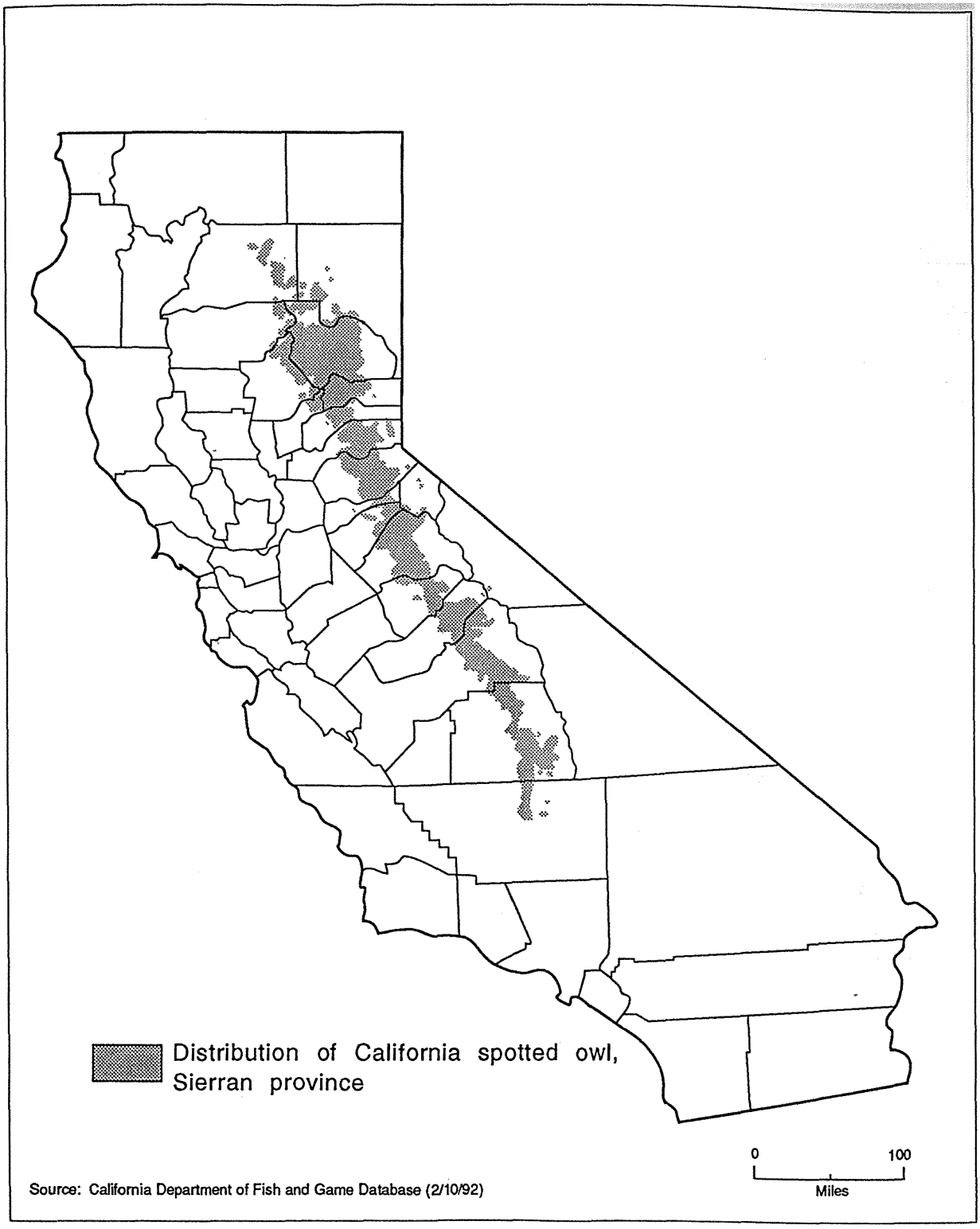
Range and Distribution

The range of the California spotted owl includes the southern Cascades south of the Pit River in Shasta County, the entire Sierran province of California, all mountainous regions of the southern California province, and the central Coast Ranges at least as far north as Monterey County (Grinnell and Miller 1944, Gould 1977, in, CASPO Report). Within this range, the owl occurs on 14 National Forests/Management Units administered by the Forest Service, four National Parks, several State Parks and Forests, private timberlands, and scattered Bureau of Land Management (BLM) lands.

The California spotted owl population can be divided into two major subdivisions: the Sierran province and the Southern California province, with Tehachapi Pass as the dividing line between the two provinces. These regions are distinct geographically and owl populations in the two provinces probably seldom exchange individuals. Connectivity may exist through the Tehachapi Mountains and the Liebre/Sawmill area east of Interstate Highway 5. The California spotted owl habitat range adjoins the range of the northern spotted owl in Shasta County.

The Sierran province addressed in this Environmental Assessment, includes the conifer forests and foothill riparian/hardwood forests of the Sierra Nevada and the southern end of the Cascade Mountains (Map 2). Approximately 72 percent of the known California spotted owl sites occur within the Sierran province. The Sierran province owl population is contiguous and fairly evenly distributed throughout the 400-mile length of the mountain range. The elevation of known nest sites ranges from about 1,000 feet to 7,700 feet, with about 86 percent occurring between 3,000 and 7,000 feet in elevation.

Approximately 80 percent of the known spotted owl sites within the Sierran province, and approximately 54 percent of the estimated acres of potential suitable habitat, occur on National Forest lands. Four National Parks, scattered BLM lands, industrial timberlands and miscellaneous private timberlands, comprise the remainder of the estimated suitable habitat and known spotted owl sites. The Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia NFs have major populations of California spotted owls, representing about 64 percent of the known owl sites. California spotted owls have also been found on the Inyo National Forest and Lake Tahoe Basin Management Unit, but only in very small numbers (Figure 1).



Source: California Department of Fish and Game Database (2/10/92)

Map 2

Figure 1 - Number of Spotted Owl Sites

Estimated numbers of California spotted owl sites in the Sierra Nevada, by ownership, adapted from the CASPO Report, 1992.

	Total known sites (known pairs) 1987-91		Estimated additional sites	SOHAs: Total per National Forest	SOHAs: Number with pairs[1]	SOHAs: Total number of pairs[2]	Sites in reserved areas 1987-91
			FEDERAL LANDS				
National Forests							
Lassen	111	(73)	26-31	40	36	42	1
Plumas	228	(112)	38-50	54	39	46	4
Tahoe	118	(75)	46-57	33	28	33	2
Eldorado	177	(123)	10-21	32	28	41	0
Stanislaus	118	(49)	15-25	36	23	23	3
Sierra	157	(81)	50-52	29	16	20	12
Sequoia	114	(71)	32-41	40	27	31	17
Lake Tahoe Basin Management Unit	2	(1)	?	0	0	0	0
Toiyabe	0	(0)	?	0	0	0	0
Inyo	3	(1)	0	0	0	0	1
Subtotal	1028	(586)	217-277	264	197	236	40
National Parks							
Lassen	4	(2)	?				4
Yosemite	56	(16)	26-41				56
Sequoia/Kings Canyon	60	(41)	20-22				60
Subtotal	120	(59)	46-63				120
Bureau of Land Management							
All Lands	1	(1)	?				0
Total Federal	1149	(646)	263-340				160
STATE OF CALIFORNIA							
State Parks	1	(1)	?				1
Other State	2	(0)					1
PRIVATE LANDS							
Industrial forests	49	(29)	?				
Other private							
Total Sierra Nevada	1250	(697)					162

[1] Number of SOHAs with at least one pair.

[2] Total number of pairs in all SOHAs (counting all pairs in each SOHA).

[3] Indicates that FS data were augmented by information from CDFG's database.

General Habitat Types

Habitat used by spotted owls in the Sierran province can be separated into five general habitat types based primarily on tree species composition:

1. Foothill riparian/hardwood: This type generally occurs at low elevations in the Sierran foothills. It includes denser stands of hardwoods adjacent to streams and on adjoining slopes. Tree species include blue oak, interior live oak, and digger pine, as well as cottonwood, California sycamore, and California buckeye within the riparian zone. Less than three percent of the owl sites in the Sierran province occur within this habitat type.

2. Ponderosa pine/hardwood: In the southern Sierra Nevada this habitat includes ponderosa pine mixed with interior live oak, canyon live oak, and black oak, with incense-cedar and white fir coming into stands at slightly higher elevations. In the northern Sierra Nevada, tanoak and Pacific madrone also contribute to the hardwood component. This habitat type blends with the upper elevations of riparian/ hardwood forests. About seven percent of owl sites in the Sierran province occur within this habitat type.

3. Mixed conifer forest: This type typically includes mixtures of white fir, ponderosa pine, incense cedar, sugar pine, black oak, douglas fir, and Jeffrey pine and red fir at higher elevations. The mixed conifer forest type is the most significant habitat for the California spotted owl. Approximately 62 percent of all California spotted owl sites on federal lands occur within this habitat type, and approximately 82 percent of all the known owl sites on federal lands in the Sierran province are within this type.

4. Red fir forest: The red fir type blends with the higher zones of mixed conifer forest. It is dominated by red fir but often includes lodgepole pine and aspen at higher elevations. Increasing amounts of white fir occur at lower elevations until it blends with the mixed conifer forest. Approximately ten percent of the owl sites on federal lands in the Sierran province are in the red fir forest habitat type.

5. Eastside pine forest: This type occurs generally east of the Sierran crest and is dominated by ponderosa and/or Jeffrey pine. Less than one percent of known owl sites in the Sierran province occur within this habitat type. Owls that have been located within this habitat type have generally been found in pine stands containing off-site inclusions of white fir. (Refer to Appendix B for more information on this topic.)

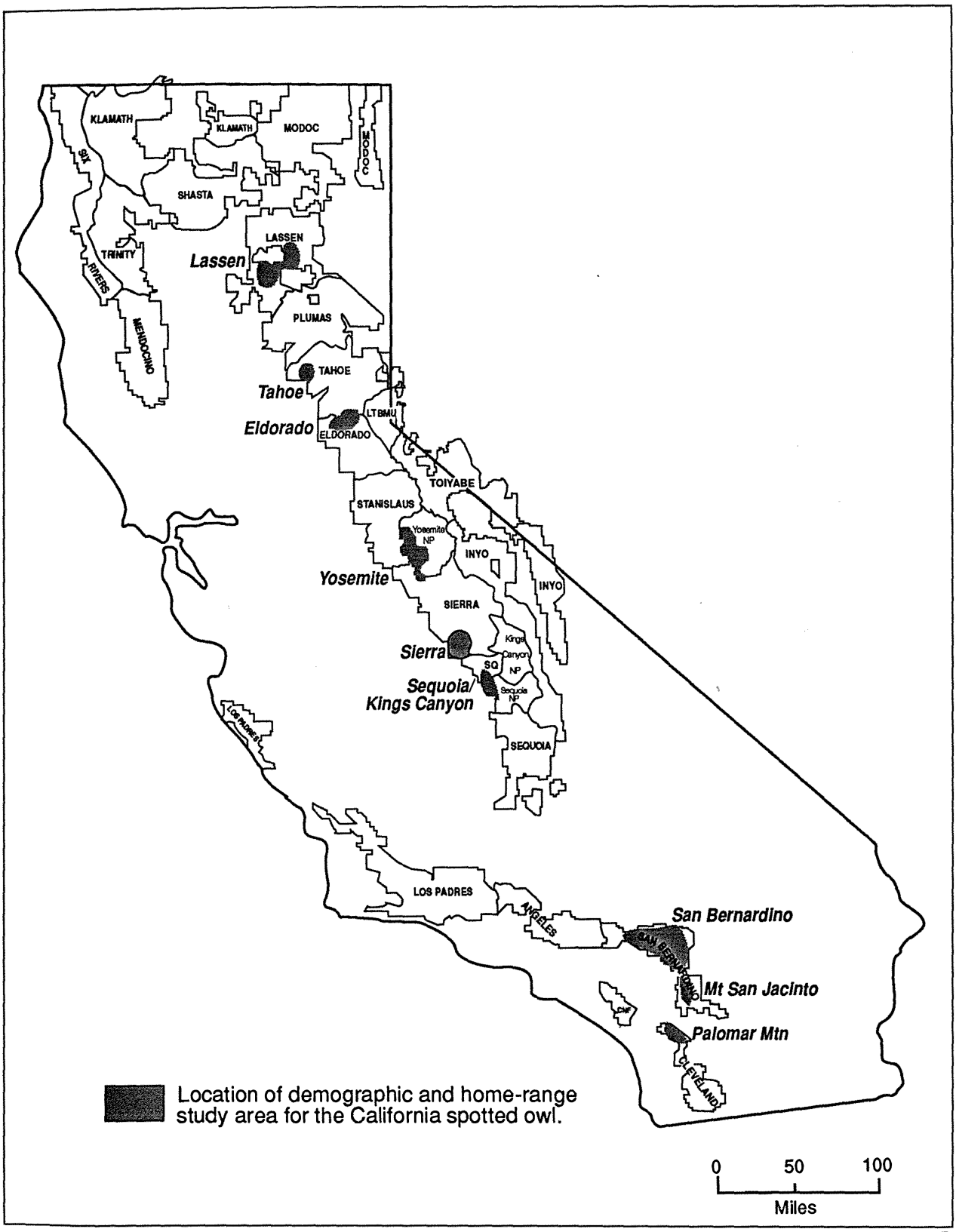
Habitat Use

Six major studies (described in the CASPO Report) have described habitat relations of the owl in four general areas spanning the length of the Sierra Nevada (Map 3). These studies examined spotted owl habitat use at different scales: at the landscape scale, at the home range scale, and at the scale of the nest, roost, or foraging stand. The following discussion provides a summary of the results of these studies. More specific information is provided in the CASPO Report, Chapters 5 and 6.

1. <u>LANDSCAPE SCALE</u>

Densities of owl sites in 1:24,000 U.S.G.S. quadrangles were found to be significantly related to the percentage of forests having medium-sized and larger trees and high canopy closure. In addition, 45 percent of all nests of California spotted owls in the conifer zone of the Sierra Nevada were in M4N and M4G stands (well-stocked, mixed conifer stands with large diameter trees-refer Appendix D for an explanation of timber strata codes). Evaluation of 148 nest sites in the Sierran province indicated that the M4N and M4G timber strata were used for nesting significantly more than expected based on their availability.

These results indicated that the M4N and M4G timber strata (inclusive of M5 and M6 strata) are selected by owls for nesting. These strata are therefore referred to as "Selected" strata in this analysis. All other strata were


KLAMATH
KLAMATH
MODOC
MODOC
SHASTA
LASSEN
Lassen
TRINITY
RIVERS
PLUMAS
MENDOCINO
TAHOE
Tahoe
LTBMU
Eldorado
ELDORADO
TOIYABE
STANISLAUS
Yosemite NP
INYO
Yosemite
INYO
SIERRA
Sierra
Kings Canyon NP
SQ
Sequoia NP
Sequoia/ Kings Canyon
SEQUOIA
LOS PADRES
LOS PADRES
ANGELES
San Bernardino
SAN BERNARDINO
Mt San Jacinto
CNF
Palomar Mtn
CLEVELAND
Location of demographic and home-range study area for the California spotted owl.
0
50
100
Miles

Map 3

used equal to or less than expected for nesting based upon their availability (Appendix B). These strata are therefore referred to as "Other Timber Strata" in this analysis. These results indicate that in mixed conifer stands used for nesting, California spotted owls clearly select stands with relatively large trees and closed canopies.

2. HOME-RANGE SCALE

At the home-range scale, attributes in nest stands were compared with those in randomly selected sites. The same analysis was conducted in roost sites and produced parallel results. Attributes of nest and roost sites are therefore described together. Attributes of foraging habitat differed and are described separately.

Nest and Roost Stands: California spotted owls consistently used stands with significantly greater canopy cover, total live tree basal area, basal area of hardwoods and softwoods, and snag basal area, than found at random sites. Mean values for canopy cover ranged from approximately 75 to 90 percent in the different studies, values for total live tree basal area ranged from 225 to 350 square feet per acre, and total snag basal area ranged from 20 to 25 square feet per acre.

In general, nesting and roosting habitat typically had greater than 70 percent total canopy cover, and nest stands typically exhibited a mixture of tree sizes with some very large, old trees present, and usually at least two canopy layers present. Nest stands usually had some large snags and an accumulation of logs and limbs on the ground.

Foraging Habitat: Attributes of foraging habitats used by California spotted owls have been estimated in only three studies. In each of these studies, the range of habitat structures used by the owls was greater in foraging habitats than in nesting and roosting habitats. For foraging, California spotted owls consistently used stands with significantly greater canopy cover, total live tree basal area, basal area of hardwoods and softwoods, snag basal area, and more dead-and-downed wood, than found at random sites. Mean values for canopy cover ranged from about 50 to 90 percent in the different studies, values for total live basal area ranged from 170 to 350 square feet per acre, and total snag basal area ranged from 15 to 25 square feet per acre.

In general, foraging owls used habitats ranging from old-aged to intermediate-aged forests, which occasionally had less than 40 percent canopy cover and relatively low tree densities. Foraging habitat typically contained a mixture of tree sizes with some trees exceeding 24 inches in dbh. This resulted in a wide range of tree heights in a stand but not necessarily in distinct layers. Foraging habitat usually exhibited signs of decadence including snags, old trees, and large downed logs. Flying space within and beneath the canopy was generally evident. Stands often contained hardwoods.

Overall Habitat Use: Results from radio-tracking studies have provided information on overall habitat use and habitat selection within an owl's home-range. Two studies of this sort within the Sierran conifer forests have shown that habitat selection was more consistent and pronounced for canopy closure than for tree size-class. In fact, the majority of owls did not have significant tests of selection for tree size-class, and most owls in the Sierra NF study used size-classes in proportion to their availability.

Canopy cover $\geq$ 40 percent was used by most California spotted owls more than expected in relation to availability, or in proportion to its availability. Canopy cover $\leq$ 39 percent was used by most owls less than expected in relation to its availability. Based on these results, suitable habitat for California spotted owls appears to include canopy cover $\geq$40 percent and trees an average of least 11 inches dbh. Habitat with $\leq$39 percent canopy cover is marginal to unsuitable (CASPO, 1992). The report concludes that a target for suitable owl foraging habitat should include at least 40 percent canopy cover in stands with trees averaging at least 11 inches in dbh.

3. STAND-LEVEL SCALE

Nest Trees: Five nest types that are used regularly by the CSO can be identified: 1) Cavity nests placed in natural cavities resulting from decay, 2) Broken-topped trees and snags, 3) Platform nests placed on remnant

platforms built by other species, or on debris accumulations, 4) Dwarf mistletoe brooms, and 5) "Undefined nest types" which do not fit any of the previous descriptions.

Data analyzed from 124 nest sites within the range of the owl indicated that nest trees averaged 44 inches in dbh, and more than 70 percent of all nest trees surveyed were larger than 30 inches dbh (CASPO Report, Chapter 5). The diameter of these trees is significantly greater than that of conifers in general in the Sierra Nevada, even in 1900, prior to logging. This means that California spotted owls in the Sierran province are selecting nest trees from among the few remaining trees that are as large or larger than average trees in 1900. The large, old trees most often selected for nest sites exhibit signs of decadence. Sixty-six percent of the nests were in large decay cavities, 19 percent were on broken topped trees or snags or on dwarf mistletoe brooms. Many of the natural cavities used for nests were created where a large branch tore out of the trunk. Typically, only very large, old trees have branches large enough to provide an adequate size cavity to accommodate a nesting owl and young. Only 17 percent of nests were on stick platforms built by other species. Sixty-three percent of nests were in live trees and 37 percent were in snags.

Summary of Habitat Use

The variability of attributes measured at nesting, roosting, and foraging sites was generally extreme. Despite this variability, California spotted owls nonetheless used a considerably narrower range of habitats than was generally available to them. To this extent, they exhibited habitat selection for many of the attributes measured. The variable nature of habitats used by California spotted owls is not well understood. It is not known if the birds survive and reproduce equally well in each of the many habitat types where they are found. In addition, all studies available on habitat use simply establish correlation, and do not demonstrate cause-and-effect relations of different stand attributes and owl use. These factors should temper inferences made about managing for functional owl habitat (CASPO Report, 1992).

Given this understanding, the CASPO Report offers the following tentative estimates of stand attributes for nesting and foraging habitat:

	Nesting/roosting stands	Foraging stands
Percent canopy cover	75-95	50-90
Total live basal area*	225-350	170-350
Large-tree basal area	150-160	50-220
Snag basal area	20-25	15-25
Downed woody debris**	3-5	3-5

* Basal area in square feet per acre.
**Percent ground covered.

In summary, some general statements regarding habitat can be made: 1) Habitat attributes for nest and roost stands confirm that most California spotted owls select dense stands with very large, old trees for nesting and roosting, 2) California spotted owls use a broader array of habitat than used by northern spotted owls for foraging, but in spite of this variation, use a considerably narrower range of habitats than is generally available to them, 3) California spotted owls in the Sierra Nevada appear to select remnants of the older conifer forests that have survived 200 to 400 years, for nest and roost locations. Within the habitat types selected, they use forest patches that are complex in structure relative to what is available (many trees in different diameter classes, high tree-species diversity, high canopy closure) (CASPO, 1992).

Despite a considerable amount of study done to understand habitat-use patterns of spotted owls, there is still little definitive knowledge about this aspect of the bird's ecology. Demographic studies have not been

underway long enough especially considering that most studies were initiated when the current drought began, to understand how different gradations in habitat suitability may affect reproduction.

Historical Changes to Habitat

Historical changes to the Sierra Nevada forests have been described in the CASPO Report, Chapter 11, and are summarized in this discussion. Also refer to the Timber discussion in this section. The Sierra Nevada has been heavily impacted for the last 100 to 150 years by mining, logging, sheep grazing, and fire suppression. Most of the changes that have occurred have been incremental.

A combination of logging and natural attrition of older trees has led to a decline in the number of large, old trees. Past logging activities that concentrated on the removal of the large, valuable trees has broken up the patchy mosaic of the natural forest, encouraging the development of dense conifer regeneration with little horizontal heterogeneity. In the ponderosa pine and mixed conifer forests of the Sierra Nevada, these activities have reduced the large-diameter trees in many areas to small remnant populations. These changes have not occurred to the same degree in the red fir type.

Fire suppression began in the early part of this century and has continued and grown in effectiveness since. Prior to the mid-1800s, Sierran mixed-conifer forests were characterized by a short-interval, low- to moderate-severity fire regime. More mesic sites such as canyon bottoms and northerly slopes, burned less often and may have tended to to provide more of the structure associated with nesting and roosting habitat used by the spotted owl.

This regime maintained surface fuels at fairly low levels and kept understories relatively free of trees and vegetation that could form fuel ladders to carry surface fires into the main canopy. The increased prevalence of white fir in the understory, brought about by fire suppression and selective cutting practices, has created hazardous fuel ladders and has substantially increased the probability of large-scale, catastrophic fires. Prior to suppression activities, high-severity crown fires usually could not be sustained over large areas, and typically affected areas less than an acre to a few acres in size. Also refer to the Fuels portion of this section for other aspects of this topic.

The effects of logging activities accompanied by fire suppression have, to varying degrees, changed the forest from one dominated by large, old, widely spaced trees to one characterized by dense, fairly even-aged stands in which most of the larger trees are 80 to 100 years old. Consequently, stands have become more complex when viewed vertically but less complex and more homogeneous in their horizontal arrangement.

Recent Changes to Habitat

Over the past 10 to 15 years, timber harvest has involved increasing amounts of even-aged management throughout the Sierra Nevada. This has resulted in conversion of mature stands to small patches (5 to 40 acres in size) of young plantations. On a landscape scale the mature forest matrix has become fragmented by small (less than 40 acre) patches of early-successional forest. Fragmentation of older forest habitat has both reduced the amount of interior forest habitat available, and increased the isolation between remaining blocks of mature forest. The creation of simple stand structures and the removal of most or all of the large diameter decadent trees and their replacements, has resulted in stands which will be devoid of large trees and large snags for many years.

Habitat Abundance and Distribution

Although we know about particular stand attributes that are used selectively by California spotted owls, distinguishing between suitable and unsuitable habitat for the California spotted owl at the landscape scale is imprecise for several reasons: (1) Logging impacts have been incremental in the Sierra Nevada, removing habitat elements to varying degrees rather than turning habitat into non-habitat; (2) A large amount of variability exists in data describing habitat attributes, and we have inadequate information about whether owls reproduce consistently and well within the range of habitats utilized; (3) At the landscape scale, there is little in the overall distribution pattern of California spotted owls to suggest ways to distinguish between suitable

and unsuitable habitat, except in very broad terms (refer to the discussion of habitat attributes at the landscape scale). Given these difficulties, identifying and tallying total acres of suitable habitat is an inexact process and much room for interpretation exists. The following information is provided based on timber strata classification (refer to Appendix D for definitions) of existing vegetation.

An estimated 2,900,000 acres of suitable or potentially suitable habitat exist on Sierran National Forest lands in Selected and Other strata. This represents about 50 percent of the total suitable habitat estimated to occur within the Sierran province (CASPO Report, 1992). Strata preferentially selected by spotted owls for nesting (Selected strata) provide 694,180 acres of habitat. Timber strata utilized for nesting in proportion to or less than their availability (Other strata) provide 2,187,625 acres of habitat (Appendix B).

Current Habitat Status and Future Trends

The combined impact of the changes that have occurred to spotted owl habitat are not fully understood. Several changes associated with past fire suppression (increased stand density, greater development of middle and lower canopy layers, more snags, more coarse woody debris) may have led to a net improvement in spotted owl habitat. However, when countered by the increased probability of catastrophic fire, and risk of extensive mortality from drought and insects, these changes cannot be viewed as long-term and sustainable. The incidence of stand-destroying fires is expected to increase in the future if fuels continue to accumulate, and the recent drought-induced bark beetle mortality will continue to contribute a large amount of new fuels. The consequence will be an increasing probability of conversion of large acreages of spotted owl habitat in the mixed conifer zone to early seral stages, far exceeding historic disturbance patterns.

Changes associated with past selective logging of the largest trees and the resulting change in diameter distributions, have resulted in a loss of key elements of spotted owl nest and roost stands (large, decadent trees; large snags; large logs). Over the past 18 months, based on project review through the Cumulative Effects Analysis process, most activity within suitable owl habitat has been deferred, resulting in few additional changes to owl habitat.

In spite of these impacts, California spotted owls continue to be widely distributed throughout most of the conifer forests of the Sierra Nevada. This indicates that, although the total amount of older forest has been greatly reduced in the Sierra Nevada during the past century, apparently enough remnant large trees exist, widely distributed today, that the owls do not exhibit major gaps in their distribution that can be attributed to logging. However, it is not known if the altered stand conditions present today are supporting self-sustaining populations of California spotted owls. Continued research is necessary to determine this.

Timber cutting trends indicate a continuing decline in the number of old trees and remnant older forest stands. Based on current Forest Plans, seventy-four percent of the National Forest lands that can potentially produce timber will be harvested in some manner, and 72 percent of the volume removed will be taken through even-aged systems according to Forest Plans. Based on LMPs, an estimated 229,000 acres per decade will be converted to even-aged forests. Even with a reduction of clearcutting and retention of some older trees in regeneration harvests, reduction of the key habitat element of very large old trees would continue to occur under the No Action alternative. (Refer to the discussion of silvicultural methods for more information.)

Where single-tree selection is practiced, a continuing loss of shade-intolerant species, such as ponderosa pine, is likely. Unless uneven-aged harvest methods are designed to bring diameter distributions into idealized distributions, a continuing loss of large trees would also be anticipated where single-tree selection is practiced.

The future landscape within the Sierra Nevada, as projected by Forest Plans, is likely to be split between areas of even-aged plantations and areas of dense and increasingly small-diameter stands. Based on these projections, the CASPO Report determined that increasing susceptibility to fire disturbance, and a sharp decline in the number of large, old trees and decadent features within forest stands, will be the future trends within spotted owl habitat on Sierran National Forests.

Home Range Size

Estimates of home-range size for California spotted owls are extremely variable. Data described in the CASPO Report indicate that they are smallest in habitats at relatively low elevations that are dominated by hardwoods, intermediate in size in conifer forests in the central Sierra Nevada, and largest in true fir forests in the northern Sierra Nevada. The mean area used was about twice as large in the northern compared to the central Sierra Nevada, and was two to 10 times larger in high-elevation conifer forests compared to low-elevation oak woodlands in the central Sierra Nevada. The large differences in home-range sizes are probably related, at least in part, to differences in the primary prey of the owls in different localities. California spotted owls with the smallest observed home ranges prey primarily on woodrats, but those with the largest home ranges specialize on flying squirrels.

The CASPO Report provides an overall estimate of about 4,200 acres for home-range sizes of owl pairs during the breeding season in Sierran conifer forests. Annual pair home ranges increased to approximately 8,200 acres, however, when the nonbreeding period was considered. Average breeding season home range size for individual birds in the northern true fir type was approximately 7,000 acres, compared to about 1,000 acres in the Sierran oak woodland type.

Amount of Habitat Within Home Ranges

Three study areas, located in the mixed conifer/true fir zone in the Lassen National Forest, the mixed conifer zone of the Sierra National Forest, and the oak woodland zone of the Sierra National Forest, provide information on the type and amount of habitat within California spotted owl home ranges. The mean proportions of individual home ranges that were $\geq$40 percent canopy cover varied between sites. The following chart summarizes data presented in the CASPO Report on the mean acreage of habitat $\geq$40 percent canopy cover, within an individual owl's home range in each of the three study areas:

	breeding season (acres)	nonbreeding season (acres)	pairs-breeding season (acres)*
Lassen NF	4,500	8,300	6,840
Sierra NF--conifer	1,600	4,500	2,550
Sierra NF--oak	600	400	780

*Pair data for the Lassen National Forest based on individual home ranges, estimating overlap between pair members.

Size of Nest Stands

Using a sample of 143 nest stands from forests in the Sierra Nevada, the CASPO Report identified the size of stands containing nest trees, and the cumulative size of each nest stand plus all adjoining stands that were in Selected strata. The mean size of nest stands was about 100 acres. The mean size of the nest stand plus adjacent suitable stands was about 300 acres.

Habitat with a total canopy cover of at least 70 percent (which can be defined as potentially suitable as nesting habitat) comprised about 17 percent of the suitable habitat within the home range of owls studied on the Sierra National Forest, and about 60 percent of the suitable habitat of owls studied on the Lassen National Forest.

Population Size

Chapter 3 of the CASPO Report describes survey efforts that have occurred to date for the California spotted owl. Surveys for California spotted owls were begun primarily in the early 1980s. From 1986 until 1989, owl survey efforts were focused on monitoring population trends, and therefore were limited to established monitoring sites. Beginning in 1989, field surveys were conducted as part of the planning for most projects. As of 1992, field surveys have been conducted on most commercial timberlands on the seven westside Sierran National Forests. An established survey protocol involving 6 visits to the site has been used over the last two years. Regional direction issued on April 19, 1992 required that Forests survey all planned timber sales and other activities using this survey protocol.

Spotted owl surveys provide an incomplete count of the spotted owl population. While most territorial owls can be located through survey efforts, surveys are much less successful at locating non-territorial birds (referred to as floaters). Floaters include juvenile birds in search of a vacant home range, and adult owls that have been displaced for some reason from a former home range. These birds have a critical role in population dynamics since they are available to join the breeding population when a territorial owl dies or deserts its territory. The number of owl sites estimated within the Sierran province accounts for only the territorial portion of the owl population; the number of floaters in the population remains unknown. The ratio of floaters to territorial birds within spotted owl populations is therefore, unknown.

Surveys, inventories, and other field efforts have identified an estimated 1,250 spotted owl sites in the Sierran province during the period of 1987 to 1991. Ninety-two percent of the known owl sites occur on public lands, and 82 percent are located on the National Forest lands addressed in this analysis. Biologists have estimated an additional 217 to 277 sites on National Forests, based on unsurveyed suitable habitat (Figure 1). An unknown number of additional sites may occur on State and private lands.

Population Density Estimates

Estimates of crude density (number of owls divided by the total acreage of the study area) were available from four areas within the range of the Sierran province of the owl. Densities varied from a high of 0.526 owls per square mile on the Sierra NF to a low of 0.259 owls per square mile on the Eldorado NF. Overall, estimates of crude density for the California spotted owl tended to be slightly lower than those for the northern spotted owl (CASPO Report, 1992).

Population Distribution

In the Sierran province, spotted owl distribution is characterized by its continuity and relatively uniform density. The CASPO Report (Chapter 3) identifies five conditions which might give rise to to some concern for the population's integrity: (1) bottlenecks in the distribution of habitat or owl populations; (2) gaps in the known distribution of owls; (3) locally isolated populations; (4) highly fragmented habitat; and (5) areas of low crude density of spotted owls.

Specific "areas of concern" (described in Chapter 3, CASPO Report) exist throughout the length of the Sierra Nevada where one or more of these conditions currently limit the owl population. These conditions have resulted from a number of causes, including natural geographic features controlling vegetation, fires, land ownership patterns, and human-caused fragmentation of habitat. The areas of concern do not represent problems at this time, but rather indicate potential areas where future problems may be greatest if the owl's status in the Sierra Nevada were to deteriorate.

Population Status

Chapter 8 of the CASPO Report discusses what is currently known about the status of the California spotted owl population. Within the Sierran province, only two demographic studies have been underway long enough to provide any estimates of the annual rate of population growth or decline. Although both study populations suggest the possibility of population declines, evidence of declining owl populations in the Sierra Nevada is inconclusive at this time. No inference can be drawn from the existing data, except to state that scientists are

uncertain about the true trends of the two populations during the study period. The information needed to conduct a population viability analysis in any sort of quantifiable manner, therefore, doesn't exist.

Among the demographic parameters investigated, reproductive rates exhibited the greatest annual variation. Factors contributing to the low and variable reproductive rates of California spotted owls need investigation. Adult survival rate is relatively high, therefore, increasing first year survival or fecundity by direct management activity may be the most feasible way to increase the growth rate of spotted owl populations.

Monitoring has been conducted by the Sierran National Forests but is relatively insensitive to declines in the overall population. This is because there are two significant lag effects that accompany habitat-induced declines in the number of territorial owls.

1. The first lag effect results from the fact that spotted owls can live for 10 to 20 years. A pair may survive for a long time and still be counted as a viable pair, but never replace itself. Consequently, a gradual decline in habitat quality could be overlooked and, over the short term, the overall population would be judged to be stable.

2. The second lag effect results because only the resident territorial population is monitored. Nonterritorial adult birds (floaters) quickly replace resident territorial birds that die, leaving no indication that the total population has actually declined. If there is a large population of nonterritorial birds, as would be expected to occur if habitat is declining, then it might be quite some time before the floater population was exhausted and an actual decline is observed in the territorial component of the total population.

The combination of these lag effects might delay, by as much as 15 to 20 years, the point at which a significant population decline could be detected through monitoring. As explained in the CASPO Report, it is clear that by the time monitoring has detected a decline in occupied spotted owl territories, habitat conditions might already have declined to a point that some critical threshold in the amount or quality of suitable habitat could have been crossed, resulting in a precipitous decline in the owl population with little chance of recovery. In addition, the life history pattern of the spotted owl (high adult survivorship and low reproductive rates) precludes rapid recovery from a population decline. The management implications of this are that any management action that lowers adult survival rate, particularly when coupled with a reduction in population size, markedly increases the likelihood of local extinction. The effects of management decisions upon the likelihood of persistence (population viability), can only be made when viewed over the long term (50 to 100 years).

Diet

Chapter 10 of the CASPO Report discusses the relationship between California spotted owls and their prey. Spotted owls in conifer forests of the Sierra Nevada, particularly above 4,000 feet in elevation, prey mainly on northern flying squirrels. Northern flying squirrels comprise as much as 60 percent of the total prey eaten in some locations. Owls in mid-to-lower elevations of the mixed conifer zone and the upper part of the ponderosa pine/hardwood zone prey heavily on both flying squirrels and woodrats. Spotted owls in the Sierran foothill hardwood forests prey almost entirely on woodrats. California spotted owls eat a variety of prey species. However, based on diet analysis, the California spotted owl appears to be a prey specialist with a search emphasis on just a few species, but one that will capture and eat a wide variety of species opportunistically. At least 85 percent of the total prey base in each sample consisted of only one to four species or species-groups.

The majority of California spotted owls (75 percent) occur in Sierran conifer forests where flying squirrels are the primary prey. Current evidence indicates that suitable spotted owl nest sites as well as the most common foods of northern flying squirrels are usually found together in mature and older forests. The density of flying squirrels has been shown to be strongly associated with the abundance of truffles (fruiting bodies of hypogeous fungi).

The abundance of hypogeous fungi, in turn, is known to be strongly associated with the presence of a well-developed soil organic layer and a large volume of decaying logs (Waters and Zabel, 1992, in CASPO,

1992). In addition, higher snag densities may be important to flying squirrel densities, since flying squirrels often use old woodpecker cavities as den sites. In Oregon, live conifers with squirrel nests averaged 49 inches in dbh; snags with cavity nests averaged 35 inches in diameter, indicating that large snags and older trees may be of particular importance to flying squirrels (Carey, 1991, in CASPO, 1992).

Woodrats comprised a small to moderate proportion (up to 37 percent) of the total biomass in spotted owl diets in studies conducted in the mixed conifer zone in the Sierra Nevada. Woodrats are typically associated with shrubfields, especially those dominated by thick-leaved evergreen species. The dusky-footed woodrat generally occurs below 5,000 feet elevation in the Sierra Nevada in shrubfields and forest communities with a mix of overstory trees and shrubs. Woodrats sometimes move from shrubfields into the edges of forests where spotted owls forage.

Management for Prey Abundance

Large differences in observed home-range sizes of California spotted owls is strongly suspected to result from differences in diet. In addition, it is suspected that the local prey base largely determines whether a given pair of owls attempts to nest in a given year, and whether nest attempts are successful (CASPO, 1992). Understanding how prey availability differs with changes in habitat structure is essential to understanding how to indirectly manage spotted owl populations by increasing suitable habitat for their prey.

In forests below the Sierran mixed-conifer zone, small scale logging operations, if done in areas adjacent to forested stands where owls are known to forage, might benefit spotted owls by enhancing woodrat populations. In the mixed conifer zone, it cannot be argued that there would be a net benefit for spotted owls by creating openings, since woodrats are generally uncommon in this zone and logging is likely to have a negative effect on flying squirrels which are the dietary staple at these elevations. Management of conifer forests in the Sierra Nevada for flying squirrels should emphasize retention of large snags and older trees, and site preparation techniques which minimize disturbance to the soil organic layer.

Breeding Chronology

The breeding cycle of the California spotted owl extends from about mid-February to mid- or late September when the young are no longer regularly cared for by their parents. Disturbance may result in nest abandonment or failure during the laying stage through the incubation stage, when the female spotted owl must remain on the nest. This period extends from early April through mid-May. Young fledge from the nest in mid- to late June typically. For the first several weeks they are very weak flyers and do not move far from the nest tree. Adults continue to bring food to the fledglings until mid- to late September.

Dispersal

Information on the dispersal abilities of California spotted owls is nearly nonexistent. An understanding of dispersal by juvenile spotted owls is essential to understanding the effects of increasing distance or spacing between adjacent pairs of spotted owls. The CASPO Report, Chapter 4, summarizes what is known about juvenile dispersal distances by northern spotted owls. This information indicates that two-thirds of the juveniles would be expected to disperse at least eight miles. Information on the extent to which fragmentation of forest habitats impedes successful dispersal is also unavailable, yet needed.

Unlike northern spotted owls, many California spotted owls are known to migrate altitudinally, moving downslope for the winter period. Spotted owls migrated a mean straight-line distance of 20 miles on the Eldorado National Forest and a mean of 12.3 miles on the Sierra National Forest. Three studies tracked 32 California spotted owls long enough to determine whether or not they migrated; from these studies 44 percent of the owls were altitudinal migrants. The reasons why some individuals migrate and others do not is still unclear. Altitudinal migration may expose owls to added sources of mortality.

Status of the Callfornia Spotted Owl

In order to evaluate the status of the California spotted owl in the Sierran province, the CASPO Report addresses three basic questions: (1) is the California spotted owl's population declining? (2) is the California spotted owl a habitat specialist? and, if the answer to question 2 is yes, (3) is the habitat upon which the California spotted owl specializes declining?

Is the population declining? California spotted owls remain widely distributed throughout their former range despite considerable alteration of their habitat over the past 100-150 years. Population lag effects (previously discussed under "population biology"), may prevent detection of any true declines through monitoring, however. Demographic studies suggest the possibility of population declines, but remain inconclusive. The only conclusion that could be made by the Technical Team is that the trends of the California spotted owl populations in the Sierra Nevada are uncertain at this time.

Is the owl a habitat specialist? As discussed in the section on "Habitat", the evidence is overwhelming that California spotted owls in the Sierra Nevada select habitats differentially from among all habitats available to them. Selectivity is strongest for nesting and roosting habitats, and weaker for foraging habitats. Nest and roost stands showed consistent, significant differences from random locations in the forest in having higher canopy cover, greater snag basal area, greater total basal area of live trees, and greater softwood and hardwood basal area. Foraging locations confirmed a wider range of habitat use, but still indicated that owls foraged in areas with significantly higher canopy closure, greater live tree basal area, greater basal area of hardwoods and softwoods, greater snag basal area, and on steeper slopes, in comparison with random locations in the forest. Overall habitat use by radio-tagged owls indicated that habitats with canopy cover greater than or equal to 40 percent were used more than or equal to their availability, whereas habitat with less than 40 percent canopy closure was used less than its availability.

Is the habitat used selectively by the owl declining? The Technical Team concluded that key habitat elements for the California spotted owl are declining within Sierran forests. Selective logging of the largest trees has resulted in significant changes in diameter distributions in the Sierra Nevada. The rapid disappearance of the large, old, and decadent trees used for nesting is described as the greatest concern. Their contribution to the overall ecological function of owl habitat, in the form or large snags and down logs, is also emphasized. Projections from Forest Plans indicates that these important stand components will disappear at a rapid rate over the next few decades if the current SOHA strategy is continued unaltered. The fact that they cannot be quickly replaced adds to the concern.

The Forest Service emphasis on Ecosystem Management is likely to alter stand prescriptions to some extent over the next few years, reducing the effects that would be predicted by strict adherence to current Forest Plans. Ecosystem Management has not been fully described, however, making it difficult to determine the extent to which it might eliminate concerns over loss of spotted owl habitat elements. The CASPO Report identifies eight major factors of concern for owl habitat in the Sierra Nevada (Figure 2). These habitat changes have resulted primarily from a combination of selective logging of the largest trees from stands and aggressive fire suppression beginning shortly after the turn of the century.

The CASPO Report concludes that effects from the gradual declines in habitat quality that have occurred for the owl in the Sierra Nevada may be subtle and, therefore, more difficult to detect than those experienced by the northern spotted owl. As a result, it may require long-term studies to detect declines associated with these more subtle habitat changes.

Figure 2 - Major Factors of Concern in Owl Habitats

Summary of major factors of concern in habitats of California spotted owls in the Sierra Nevada, reasons for those factors, and their impacts on the owls.

Factor	Reason(s) for the factor	Impact on spotted owls
Decline in abundance of very large, old trees	Selective logging of the largest trees from stands	Loss of the owl's preferred nest sites
Long recovery period for spotted owl habitat after logging	Selective logging of the largest trees from stands	Less of total landscape in suitable owl habitat at any given time
Ingrowth of shade-tolerant tree species, creating unnaturally dense stands with ground-to-crown fuel ladders	Selection harvest; aggressive fire suppression; sheep grazing, which created ideal seedbeds for conifer germination late last century	Increased threat of stand-destroying fires
Excessive build-up of surface fuels	Aggressive fire suppression over the years 90 years, leading to higher densities of trees, more competition for space and water, so a higher death rate of trees	Increased threat of stand-destroying fires
Loss of large-diameter logs from the decaying wood source on the ground	Intentional fires by sheepherders; selective logging of largest trees; piling and burning logs after logging; domestic fuel-wood removal	Potential decline in flying squirrel densities via loss of fungi that are a dietary staple for the squirrels
Decline in snag density	Selective logging of the largest trees from stands; salvage logging; fuel-wood removal	Loss of potential nest sites for owls; loss of dens sites for flying squirrels; loss of a source of large logs for decay needs on the ground
Disturbance and/or removal of duff and topsoil layers	Sheep grazing; mechanical disturbance from logging equipment, skid trails, and so on; increase surface fuels that burn hot enough to destroy duff layer	Potential decline in flying squirrel densities via loss of fungi that are a dietary staple for the squirrels
Change in composition of tree species (fewer pines and black oaks, more firs and incense-cedar	Selective logging of the largest trees, particularly pine species, from stands; aggressive fire suppression	Some loss of nest sites; other effects unknown

Management Options

To ensure stable owl populations in the Sierran province, it is necessary to retain the amount and spatial pattern of habitat that will provide for a long-term balance between owl birth and death rates. Because spotted owls are still widely and evenly distributed throughout the conifer forests of the western Sierra Nevada, the Technical Team favored an alternative that maintains the existing number and distribution of owls for an interim period. The CASPO Report concludes that management during this period should not foreclose options for whatever long-term strategy may be developed.

If suitable habitat is allowed to decline and become fragmented, then management of the California spotted owl within large habitat conservation areas may be the only remaining management option, according to the Technical Team. This option (as discussed in the CASPO Report, Chapter 1) would require maintaining a balance between the rate of habitat loss to fires and the rate of habitat recovery from fires and would therefore represent considerable risk in itself.

A desired landscape approach to managing for the California spotted owl should consider several principles of conservation biology that relate to species associated with late-successional forests, and have been summarized in the Recommendations for Managing Late-Seral-Stage Forest and Riparian Habitats on the Tahoe National Forest (1992):

- Species that are well-distributed across their range are less prone to extinction than those that are restricted to a portion of their former range.
- Large blocks containing many pairs of each species will sustain species better than small blocks with few individuals.
- Blocks of habitat that are close together are better than those that are far apart.
- Contiguous, unfragmented habitats are better than fragmented areas.
- Habitat is generally more useful for dispersal, daily movements, and migration if it closely resembles suitable habitat for a species in question.
- Connected blocks of habitat are better than unconnected blocks of habitat.
- Management strategies that provide habitat throughout the landscape are more able to withstand large disturbances than those that concentrate habitat.

Environmental Effects

EVALUATION OF ALTERNATIVES

The CASPO Report concludes that a successful strategy for the California spotted owl in the Sierra Nevada must be designed both to ameliorate the negative effects of the factors described in Figure 2, and to also address the problems of forest fragmentation anticipated under current Forest Plan management. A successful long-term strategy for spotted owls in the Sierra Nevada must result in the clustering of pairs such that many occur as neighbors with overlapping home ranges. Any short-term management strategy for the California spotted owl must therefore, maintain future management options by maintaining the population in its relatively even distribution throughout the forests of the western slope.

Considering this overall goal, the Report concludes that an interim strategy must accomplish the three primary objectives which were discussed in the Purpose and Need-Objectives section of this document. The following factors must be evaluated in determining the extent to which any proposed management action will ensure that future management options are maintained:

****Key Indicator: (1) Changes in the amount and distribution of suitable habitat**

If future management options are to be maintained, changes in the amount and distribution of suitable habitat must not result in an increase in the mean nearest-neighbor distances among suitable pair sites, according to the CASPO Report. Fragmentation of existing habitat will reduce the size of patches of older forest and increase the isolation between patches of suitable habitat. This is likely to affect spotted owls in several ways:

a. Increasing the isolation of patches of suitable habitat will increase the risk associated with juvenile dispersal and will reduce opportunities for successful mate location;

b. Fragmentation and loss of habitat, particularly within nest and roost stands, will reduce the amount of interior forest habitat and increase associated "edge effects." (Refer to the Glossary - Appendix A.) This could result in lower quality of the remaining habitat due to higher risk of predation and changes in microclimate; and

c. A reduction in the amount of suitable habitat within an owl's use area and fragmentation of existing habitat will increase the distance that owls would need to fly to find food. This may result in abandonment of the site or failed reproduction if the prey availability is insufficient to support an owl pair. Loss of spotted owl nest sites will reduce population density and increase the spacing between neighboring pairs. This in turn will further reduce likelihoods for successful dispersal.

Models that take into account the spatial structure of spotted owl populations indicate that if population densities are very low, or the amount of suitable habitat is greatly reduced, a threshold point exists beyond which the owl populations collapse to extinction (CASPO Report, 1992).

****Key Indicator: (2) Changes in the quality of habitat**

Factors which uniformly decrease habitat quality will also act to reduce spotted owl population density. Habitat quality at the scale of an owl's home range may determine the survival and birth rates for an individual pair of owls. In order to assure persistence of the subspecies, it is essential to provide habitat of sufficient quality, throughout the subspecies range, to ensure a long-term balance between birth and death rates. The CASPO Report identifies several "factors of concern" for the owl which are a function of changes in habitat quality. These are:

a. The decline in the abundance of very large, old trees,

b. The loss of large diameter logs from the decaying wood source on the ground,

c. The decline in snag densities,

d. The disturbance and/or removal of duff and topsoil layers, and

e. Changes in the composition of tree species (fewer pines and black oaks and more firs and incense-cedar).

As discussed in the Affected Environment portion of this section, these factors contribute to the quality of owl habitat in the following manner:

Large, Old Trees: The importance of large, decadent trees as nest sites is evident from the discussion in the Affected Environment. In addition, larger trees are needed to provide large snags and longer-lasting components of dead, decaying wood on the ground.

Downed Woody Debris and Soil Organic Layer: The density of flying squirrels has been shown to be closely associated with the abundance of truffles; truffles are known be be associated with a large volume of decaying logs and a well-developed soil organic layer. Management practices that de-

crease the soil organic layer or the abundance of large, decaying logs will reduce the capability of the habitat to support flying squirrels, and possibly spotted owls as well.

Snags: The use of snags as owl nest sites has been discussed in the Affected Environment. They also play a role in prey abundance, because woodpeckers are occasionally eaten by spotted owls, and because flying squirrels often use old woodpecker cavities as den sites. Snags eventually contribute to the accumulation of decaying logs

Tree Species Composition: Variety in tree species composition provides additional structural diversity in a stands by contributing to the development of multiple canopy layers. The importance of multiple canopy layers for spotted owls is not well understood. The structural diversity provided by different layers may provide opportunities for owls to move to perches at a variety of heights as they search for prey. On the other hand, multiple layers may be a covariate of some other component of the owl's habitat that is vital, such as the owl's prey. It has also been observed that owls typically select stands with high tree species-diversity, however reasons for this association are also not well understood.

In addition to the these factors, habitat fragmentation and resulting "edge effects" can reduce the quality of habitat. As patches of habitat become smaller, changes in microclimate will result in drier conditions with more available light; these conditions may reduce growth of hypogeous fungi and negatively affect flying squirrel populations. Microclimate changes associated with edge have been estimated to extend up to 160 meters inside a patch (Franklin and Foreman, 1987). The possibility of increased risk of predation to spotted owls as a result of increasing amounts of edge may also reduce the quality of smaller habitat patches (although the extent of these effects is not really known).

****Key Indicator: (3) Recovery period following logging**

The length of time required for recovery of spotted owl habitat following logging was identified in the CASPO Report as a "factor of concern" for the Sierran province. It will affect the amount of suitable habitat available at any future point in time and will also affect the degree to which a proposed action will maintain future options for management of the subspecies. The amount of risk associated with any strategy which proposes to reduce the amount or quality of suitable habitat over the next few years, will be related to the length of time required to re-create suitable habitat conditions. As the length of time needed to recreate suitable habitat and its important elements is reduced, so is the risk associated with implementing a proposed habitat alteration.

****Key Indicator: (4) Probability and magnitude of habitat destroying fires**

The probability and/or magnitude of stochastic events is an important consideration in assessing the persistence likelihood of a species. Changes in the likelihood and magnitude of fires is a primary concern in evaluating management strategies for the California spotted owl. The CASPO Report identifies two "factors of concern" related to this issue: (1) the ingrowth of shade-tolerant tree species, creating unnaturally dense stands with ground-to-crown fuel ladders, and (2) the excessive build-up of surface fuels.
These factors have resulted in a dramatic increase in the likelihood, severity, and size of fires and trends are expected to increase over the next several years. The net result is a much higher incidence of stand-destroying fires at present and in the future than was characteristic of the Sierran fire regime prior to this century. Because fires and their subsequent impact on owl numbers are inevitable, it is necessary to maintain a balance between the rate of habitat loss to fires and the rate of habitat recovery from fires. The effects of each alternative on long term fuel loading and fire occurrence are discussed in the section addressing the issue of "reducing the risk of fires which would make California spotted owl habitat unsuitable."

IMPLEMENTATION OF ALTERNATIVES

This analysis anticipates implementation of the selected alternative part way through Fiscal Year (FY) 1993. Whichever alternative is selected, it is assumed that a number of projects with decisions signed prior to implementing the Interim Guidelines will proceed in calander year 1993. These projects will have been planned under the existing CEA process (Appendix B), and their effects are described in the discussion of

Cumulative Effects. Appendix B provides a detailed description of the existing CEA process, and describes some potential effects. This analysis of the alternatives describes only those effects associated with the actual implementation of each alternative.

Alternative 1 - No Action

****Key Indicator:** **(1) Changes in the amount and distribution of suitable habitat**

Habitat Reduction

Even-aged regeneration harvest systems (clearcut, shelterwood, overstory removal) will generally convert suitable owl habitat to unsuitable habitat. Other prescriptions may or may not maintain suitable habitat depending upon how they are implemented (refer to the discussion on Habitat Quality). Under this alternative, approximately 9,920 acres would be harvested annually in 1993 and 1994 with even-aged regeneration prescriptions. Assuming harvest occurs in proportion to strata abundance, a reduction of 2,380 acres of habitat selected for nesting and roosting (Selected strata), and 7,540 acres of other habitat or potential habitat (Other strata) would occur annually for the next two years.

Fragmentation

Because harvest will primarily be accomplished under even-aged regeneration prescriptions, fragmentation of owl habitat will increase. As the distance increases between patches of suitable owl habitat, consequences include reduced probabilities for successful dispersal of juvenile owls, and reduced opportunities for successful mate location. Increased predation upon owls and increased energy expenditure by owls for foraging are also likely consequences.

Nest Stands

This alternative will maintain nest stands for 236 owl pairs known to occur within SOHAs. An additional 40 owl sites occur on lands which are unavailable for timber harvest for other reasons (Wilderness Areas, for example). Although surveys for owls would continue to be conducted, there are no specific requirements for protection of spotted owl nest stands outside of SOHAs. It is likely that habitat will be reduced and fragmented within nest stands which are not within designated SOHAs. The number of owl nest stands likely to be eliminated over the next two years cannot be predicted without conducting a closer analysis on a project by project basis. In the worst case scenario, nest stands may be harvested and all available suitable habitat surrounding the nest stand may be harvested. Three-quarters of known nests are not protected within SOHAs or reserve areas.

Consequences to Owl Sites

The CEA analysis process conducted through 1991, provides some indication of the extent to which spotted owl sites would likely be affected by reduction in habitat resulting from timber harvest over the next two years. Results of Cumulative Effects Analyses conducted for various timber sale projects throughout 1992 indicate that most spotted owls in the Sierra Nevada have a limited number of acres of suitable habitat available to them and could be affected by even small reductions in their available habitat. Thirty-three of 59 timber sales analyzed through the CEA process in 1992 (data compiled through July) identified potential effects to spotted owls through a reduction in habitat. Mitigation measures were applied to the sales, or other alternatives selected which eliminated or reduced these effects.

Consequences of the loss of individual owl sites upon the entire owl population cannot be fully predicted. While there is no indication that a population threshold point would be crossed within the next two years, the fragmentation and reduction in the amount of suitable habitat likely to occur under this Alternative would result in a loss of owl sites, thereby increasing nearest-neighbor distances, and reducing options for future long-term management strategies.

Long-Term Effects

If continued as a long-term management strategy, the eventual reduction and fragmentation of suitable habitat would result in few spotted owls persisting on National Forest lands outside of SOHAs. The Technical Team concluded, as for the northern spotted owl, that the SOHA strategy had a low likelihood of maintaining the owl population over the next 50 to 100 years. Five reasons were provided for this conclusion:

1. Empirical studies show that the likelihood of extinction among bird populations increases dramatically with decreasing numbers of pairs in a block of habitat. The SOHA strategy provides habitat for only one to three owl pairs in a unit, separated by 6-12 miles from other units. Because isolated pairs are known to exhibit excessively high extinction rates, owl pairs in SOHAs would be expected to disappear at a relatively high rate leaving SOHAs unoccupied and non-functional. This would make dispersal a growing concern because replacement of members of a lost pair would require dispersing owls to search extensive areas of unsuitable landscape before locating an unoccupied habitat area.

2. Social interactions among pairs of owls increases calling frequency where several pairs are located. Without adjacent pairs, this calling would be reduced and would therefore make it more difficult for dispersing birds to locate other owls of the opposite sex in good habitat.

3. SOHAs are often composed of small patches of habitat that have a high ratio of edge to area. This means that much of the habitat provided does not serve as forest interior habitat, and changes in forest microclimate and increased predation risks likely decrease the suitability of these small habitat patches.

4. SOHAs are vulnerable to small-scale catastrophes because of their small size. Loss of SOHA habitat due to wildfire removes it from the network for perhaps 80 to 150 years and increases the mean dispersal distance between remaining SOHAs. This would further reduce the chance of dispersing owls finding unoccupied but suitable sites.

5. Because the amount of suitable habitat in a SOHA is often insufficient to support much more than a single breeding pair, it is unlikely that non-territorial owls (floaters) would be adequately recruited into a breeding population.

****Key Indicator: (2) Changes in the quality of habitat**

The various harvest prescriptions available under this alternative and their effects upon owl habitat characteristics are described in Figure 11, within the section on silvicultural prescriptions. Approximately 74 percent of the lands that can potentially produce timber are available for harvest under one or more of these prescriptions.

Seventy-eight percent of the acres harvested for green timber volume in 1993 and 1994, will be harvested using even-aged regeneration prescriptions, as projected by Forests (Figure 12). As previously discussed, the effect of this even-aged harvest within owl habitat, is essentially a conversion of habitat to non-habitat for spotted owls. In addition, this harvest will affect the quality of remaining habitat as patches of habitat are reduced in size and develop a high ratio of edge to area. Changes in forest microclimate within these small patches, increased risk of predation, and increased isolation of habitat patches, will decrease the suitability of highly fragmented habitat. These effects will increase over the next two years based on the projection of 9,920 acres to be harvested yearly under even-aged regeneration prescriptions.

On the smaller percentage of lands where uneven-aged management occurs, habitat may remain suitable for spotted owl use following harvest, but it is likely that important habitat elements will be removed, reducing the quality of the habitat. The extent of this occurrence will vary depending upon the type and intensity of the uneven-aged harvest prescription. To the extent that large trees and sufficient canopy closure and structure are retained, habitat quality may be maintained under prescriptions for individual tree selection and small group selection.

The following "factors of concern" related to habitat quality, and identified by the CASPO Report, will be affected over the next two years:

Decline in the abundance of very large old trees. This alternative will result in a continued decline in the abundance of large, old trees as a result of both even-aged and uneven-aged harvest systems.

Loss of large diameter logs. Forest Plan Standards and Guidelines vary in their requirements for retention of downed logs (Appendix B). Many Forests require retention of at least 3 downed logs per acre greater than 20 inches dbh. However, the presence of large downed logs is a function of snags and a continuing supply of large green trees for their recruitment. When these elements are removed from the forest through even-aged harvest prescriptions, the continued recruitment of large diameter logs will be eliminated until these elements redevelop in the stand--a period of perhaps 150 to 200 years.

Decline in snag density. Under this alternative, existing Forest Plans would prescribe minimum snag retention levels (Appendix B). Most Sierran Forest Plans require a minimum of 1.5 snags per acre, of which 0.3 snags per acre should be greater than 24 inches dbh. These standards will result in declines in snag densities, particularly densities of snags large enough to function as spotted owl nest trees and dens for flying squirrels. Where lands are managed to meet minimum standards for snag retention specified in Forest Plans, they will provide much less than the 20 square feet per acre in basal area of snags which the CASPO Report offers as a tentative estimate for this stand attribute in owl habitat. Approximately 9,105 acres of salvage timber harvest are projected annually over the next two years under this alternative.

Change in tree species composition. Even-aged regeneration harvests provide opportunities to favor the reproduction of light intolerant species (pine) over tolerant species (fir and incense-cedar). Fire suppression policies that prevent openings in the forest from occurring naturally have caused a shift toward the regeneration of tolerant species. Artificial regeneration through planting, as currently practiced, provides at least a 50 percent mix of pine in the regenerated stand. This will help to offset the historic trend toward an increasing composition of fir, and a decrease in pine species.

Disturbance of the duff and topsoil layer. Site preparation for regeneration will occur on a majority of the acres harvested for green timber volume over the next two years. The degree to which the topsoil layer will be disturbed through these activities is dependent upon the methods used for site preparation. The full range of site-preparation techniques is available under this alternative.

Harvest that occurs within SOHAs should maintain at least 1,000 acres of suitable habitat at all times. However, not all SOHAs currently have 1,000 acres of suitable habitat. The CASPO Report raises concerns about the quality of this habitat as some SOHAs are composed of small patches of habitat that have a high ratio of edge to area.

****Key Indicator: (3) Recovery period following logging**

Outside of SOHAs, recovery of spotted owl nesting and roosting habitat following logging will probably be in excess of 150 years on sites harvested by clearcutting. Even-aged regeneration prescribed under this alternative, in particular clearcutting, will result in the removal of most or all large, old trees from harvested areas, in addition to the trees that would replace them when they fall. This, in turn, will lead to a loss of large-diameter downed woody material. Even-aged harvest methods such as shelterwood however, would leave more of this material (large trees), and recovery time would be shorter (assuming the overstory removal is not done).

In an even-aged system these old-growth features will require a long period of time to recover. Since decadent features are a function of stand age and not just tree diameters, important habitat elements for spotted owls (cavities, broken-tops, snags, large woody debris) will typically take in excess of 150-200 years to replace within mixed conifer stands (JoAnn Fites, 1992; personal communication). Habitat suitable for foraging will be replaced more quickly; perhaps within 40 to 70 years. While spotted owls are likely to use this habitat, it

may be another 70 to 100 years before many of the structural elements typically found within foraging habitat and thought to be important for prey abundance (some large trees, snags, and logs) are available.

On the 2,590 acres projected to be harvested annually through uneven-aged systems over the next two years, results are likely to be similar unless harvest prescriptions will leave many of the large, old trees. Most Forest Plans call for uneven-age prescriptions to be applied for reasons other than owl habitat. If large trees are removed in prescriptions calling for individual tree selection, and if no stocking control is performed in the smaller size classes, replacement trees in the large diameter classes will be produced very slowly. On the other hand, if individual tree selection is practiced in a manner that conforms to classic theory (brings diameter distributions into an idealized distribution referred to as an inverse "J") and the management objective includes sufficient large, old trees, then stands harvested through individual tree selection could recover and provide owl habitat quite rapidly.

****Key Indicator: (4) Probability and magnitude of habitat destroying fires**

SOHAs are vulnerable to small-scale catastrophes because of their small size. Loss of SOHA habitat due to wildfire removes it from the network for perhaps 80 to 150 years and increases the mean dispersal distance between remaining SOHAs. This would further reduce the chance of dispersing owls finding unoccupied but suitable sites. For this reason, the SOHA network cannot be considered to be a workable strategy for maintaining spotted owl habitat in the long-term.

Refer to the section on fire and fuels for a discussion of the effects of this alternative on fuel profiles and fire occurrence. In general, this alternative will result in little or no reduction in the number of acres with a high tendency to burn in crown fires.

Alternative 2 - CASPO

****Key Indicator: (1) Changes in the amount and distribution of suitable habitat**

Habitat Reduction

Under the harvest prescription utilized in this alternative, habitat selected for nesting and roosting would remain suitable for owl use following harvest. It is more difficult to determine to what extent the prescription applied to Other strata may maintain habitat suitable for owl use. Canopy closure in some stands will be reduced below 40 percent, however many other attributes of suitable habitat will be retained. Assuming harvest occurs in proportion to strata abundance, harvest of about 9,287 acres of habitat classified as Other strata would occur annually for the next two years (it is likely that the proportion would actually be higher, as much of the Selected strata will occur in PACs). A proportion of this habitat would be made unsuitable for owl use due to the reduction in canopy cover.

Fragmentation

This alternative will reduce the effects of forest fragmentation from those described in the No Action Alternative. The harvest prescriptions described in this alternative will create patches of habitat with lower canopy cover, and will at times, reduce the size of existing patches of dense-canopied older forest. The effects of this type of habitat fragmentation are less severe than those described in Alternative 1 for two reasons: (1) Harvest will maintain a continuity of large trees across the landscape, even in stands with reduced canopy cover. This will reduce the contrast between suitable owl habitat and the surrounding landscape, reducing edge effects. It may also increase the likelihood of owls successfully dispersing and moving through areas recently harvested. (2) Harvest is not allowed within 300 acres surrounding spotted owl nest and roost sites. This assures that existing nest and roost stands will not be fragmented and that an adequate size patch (discussed in Chapter 5 of the CASPO Report) will remain surrounding these sites to provide interior forest habitat conditions.

Nest Stands

This Alternative will protect known nest and roost stands for at least 1,028 spotted owl sites that were identified from 1987 through 1991, and an unknown number of additional sites located through surveys conducted in 1992. It will maintain the best continuous 300 acres of habitat surrounding these nest or roost stands. The Alternative does not require additional survey efforts to locate new owl sites, and does not require any particular protection around newly located sites. Therefore, harvest activities may still occur within a number of owl nest stands that have not yet been identified. (An additional 217-277 owl sites are predicted to occur on Sierran Forest lands not yet surveyed).

The risk of harvesting habitat over the next two years within a substantial number of these sites is low. In addition, because owl sites are presently widely and evenly distributed throughout the mixed conifer zone, lower red fir type, and much of the ponderosa pine/hardwood type, and because this alternative ensures that important habitat elements are retained in these habitat types, maintaining the currently known nest stands over the next two years will provide a high degree of protection for the owl.

Consequences to Owl Sites

Under this alternative few owl sites would be likely to be eliminated over the next two years as a result of habitat reduction through timber harvest activities. Selected strata harvested under the requirements of this alternative, would remain suitable for owl foraging (at least within several years). Canopy cover could be reduced within Other strata to the point that the habitat is no longer suitable for owl foraging. However, provisions for protecting 300 acres surrounding existing nest and roost stands and for retaining 40 percent canopy closure within Selected strata assure that the most selected habitat is available for nesting and/or foraging, and some of the Other strata may also remain suitable for foraging despite the potential for reducing these stands to 30 percent of their basal area.

****Key Indicator:** **(2) Changes in the quality of habitat**

Alternative 2 provides minimum retention standards for certain habitat elements, and is not a harvest prescription in and of itself. The actual effects of this alternative on habitat quality will depend on the extent to which these minimum values are exceeded. The management described in this alternative would maintain the existing quality of habitat within 300 acres surrounding owl nest or roost sites.

As displayed in Figure 12, 12,220 acres would be harvested yearly under the guidelines described in this alternative. Within Selected strata, harvest would reduce the quality of habitat primarily due to the reduction in canopy cover. Because harvest could reduce canopy cover in these strata to 40 percent, suitable nesting habitat **will,** in most cases, be altered to the point that it is no longer suitable for nesting but would be used for foraging within a few years following harvest. Within Other strata, harvest under these guidelines will often result in less than 40 percent canopy closure, and make these stands temporarily unsuitable for owl use. The other important elements of suitable habitat (large snags, large downed-logs, large diameter trees) will be retained under these guidelines. Following harvest, the primary habitat element missing will be adequate canopy closure.

This alternative will affect the "factors of concern" identified in the CASPO Report as follows:

> **Decline in the abundance of very large old trees:** This alternative will ensure that within both suitable and potential spotted owl habitat, (Selected and Other strata) the abundance of large, old trees will not continue to decline from Sierran forests.
>
> **Loss of large diameter logs:** Because large, old trees and snags will be retained under harvest guidelines for this alternative, future recruitment of large diameter logs will be ensured. In addition, guidelines for retention of at 10 to 15 tons per acre in the largest logs available, ensures that large logs will not continue to decline from Sierran forests.

Decline in snag density: Guidelines for retention of snags in this alternative are based upon the average basal area of snags found within spotted owl nest stands and foraging stands in the Sierra Nevada. The retention of snags larger than 30 inches dbh (to a maximum of 8), and the retention of at least 20 square feet of basal area in the largest snags will generally maintain snags at a density thought to be adequate for owl habitat (CASPO Report, 1992). A decline in snag densities might still occur within previously unmanaged older forest stands. Within these stands, average snag basal areas have been found to be about 40 square feet per acre, both in red fir and mixed conifer types. However, even within these stands, snags larger than 30 inches (to a maximum of 8) would be retained. Within PACs, all snags are retained, therefore, no decline in snag density will occur in these areas.

Change in tree species composition. Where large trees are spaced uniformly through a stand, regeneration of shade-tolerant fir and cedar would be favored. However, in some areas large trees will be clumped so that there will be openings large enough to allow for regeneration of shade intolerant pines. Without some experience in applying this alternative, it is difficult to predict the extent to which shade tolerant versus intolerant species will be favored (also refer to the silvicultural discussion).

Disturbance of the duff and topsoil layer. This alternative emphasizes the use of non-intensive site preparation techniques to avoid disturbance of the topsoil layer. The degree to which the topsoil layer will be disturbed through these activities is dependent upon the methods used for site preparation. The full range of site-preparation techniques is available under this alternative.

****Key Indicator: (3) Recovery period following logging**

One of the primary objectives of the CASPO Report recommendations is to retain those stand components that are most at risk and hardest to replace, thereby reducing the length of time needed for important habitat elements to redevelop. Because dense stands of small to medium sawlogs can return to a site in a few decades, this alternative does not focus on retention of those elements, but rather, on the large diameter, decadent trees, snags, and downed-logs. The rate of recovery to either nesting or foraging habitat depends heavily upon specific stand structure and will be highly variable even within strata.

Where harvest occurs within Selected strata, the goal is to leave these stands in or near a condition that would be suitable for spotted owl foraging. The CASPO Report predicts that a very brief period (probably less than 5 years) would elapse following logging before this habitat was suitable for foraging by spotted owls. The recommendations also focus on the ability to replace large old trees within harvested stands. Given average stand conditions, trees greater than about 25 inches dbh would be retained in most of the Selected strata. Because trees of this size can be produced in less than 100 years on most sites, an ample number of replacement trees can be produced to replace the existing large, old trees as they fall. It would take up to 60 years for habitat harvested under the guidelines for Selected strata to develop the 70 percent canopy cover generally associated with nesting and roosting habitat.

Where harvest occurs within Other strata, most stands would not serve as suitable foraging habitat immediately following harvest due to the reduction in canopy closure. Stands could be reduced down to a minimum of 50 square feet of basal area, which would provide less than 40 percent canopy cover. Retention of the existing large, old trees where they exist, and replacements for these trees, will ensure a continuing source of future large snags and decaying logs. Foraging habitat could probably be created within 20 years in most cases, and in many cases, suitable nesting habitat in less than 50 years.

****Key Indicator: (4) Probability and magnitude of habitat destroying fires**

Because this alternative maintains the existing distribution of owl sites, it reduces the risk to owls associated with the loss of any particular block of habitat from catastrophic fire. Refer to the section on fire and fuels for a discussion of the effects of this alternative on fuel profiles and fire occurrence. Stands which are harvested under the requirements of this alternative will have a greater chance of tree survival during fires due to

reduced fuel ladders and larger tree size. This alternative will result in fewer acres with a high tendency for crown fires than Alternative 1.

Alternative 3 - Modified CEA Process

****Key Indicator:** **(1) Changes in the amount and distribution of suitable habitat**

Habitat Reduction

This alternative will eliminate very little spotted owl habitat; much of the currently suitable owl habitat is utilized by owls and under this alternative would not be harvested. Results of the CEA process conducted up till July of 1992 found that habitat excess to the needs of the owl, was available in only five of 59 sales analyzed. In the mixed conifer zone this alternative would retain about 2,500 acres of suitable owl habitat within each owl use area (or all that is available where less than this amount exists). In the red fir zone, up to 6,800 acres of suitable habitat would be retained within owl use areas. Within the mixed conifer zone this requirement is likely to retain 80 to 90 percent of the existing suitable spotted owl habitat in an unaltered condition. Because the density of spotted owl sites is lower in the red fir zone, there may be more opportunity to harvest suitable habitat within this type.

About 7,300 acres of green timber harvest would occur annually in 1993 and 1994. Most of this harvest would occur outside of what is currently suitable habitat. Where suitable habitat is harvested, it may or may not remain suitable for owl use following harvest (for reasons discussed in Alternative 2).

Fragmentation

This alternative will maintain most of the existing suitable habitat contained within owl use areas without any reduction in canopy cover. Existing patches of older forest will generally remain unaltered where they occur within a known or predicted owl use area, unless the habitat is determined to be surplus to the needs of the owls. Of 219 owl use areas analyzed for CEA documents on the Lassen, Tahoe, Eldorado, and Sequoia National Forests, only 5 owl use areas contained more than the average amount of suitable habitat determined from radio telemetry studies to be used by spotted owl pairs.

There are several possible explanations why so few owls appear to be using amounts of suitable habitat similar to the owl pairs studied in telemetry studies: (1) The definition of suitable habitat differed between the CEA process and these studies. The previous CEA process mapped only habitat as suitable with at least 50 percent canopy closure and half the overstory in dominant trees. The telemetry studies evaluated the percentage of the home range with total canopy cover of 40 percent or greater. (2) Mapping of owl use areas for the CEA process are estimates and may not always represent the full area being used by an owl pair. (3) The sample sizes from telemetry studies are small, and they may not represent the variation that actually occurs throughout the Sierra. (4) Owls outside of the two study areas may have less than adequate amounts of suitable habitat available to them.

Because we do not know which of these factors may be responsible for the difference between telemetry studies and mapped owl use areas, the telemetry studies represent the most reliable information on home range size and amounts of suitable habitat typically used. Where harvest would occur under this alternative, effects of habitat fragmentation are reduced for the same reasons described in Alternative 2.

Nest Stands

Effects are the same as those described for Alternative 2.

Consequences to Owl Sites

It is not anticipated that any spotted owl sites would be eliminated through management activities. Spotted owl habitat would not be reduced below levels typically found within a pair's use area. Within each owl use

area, the best 300 acres of habitat surrounding an owl's nest/roost site would be retained, and in mixed conifer habitats, all available suitable habitat up to 2,500 acres would also remain undegraded.

****Key Indicator: (2) Changes in the quality of habitat**

There would be no change or reduction to the quality of a large percentage of the existing owl habitat. Within each of the known 1,028 owl sites, up to 2,500 acres (or more depending on location) would be maintained without any degradation.

Where harvest does occur under this Alternative, the effects upon habitat quality would be the same as those described in Alternative 2. As shown in Figure 12, 7,300 acres would be harvested yearly under the prescriptions described in this alternative. The "factors of concern" would be addressed to the same extent as described in Alternative 2.

****Key Indicator: (3) Recovery period following logging**

This alternative incorporates all the CASPO Report recommendations to retain large trees, snags, and down logs within harvested habitat. It is therefore similar to Alternative 2 in the degree to which it shortens the period of time necessary for re-development of important habitat elements. Because dense stands of small to medium sawlogs can return to a site in a few decades, this alternative does not focus on retention of those elements, but, rather, on the large diameter, decadent trees, snags, and downed-logs.

****Key Indicator: (4) Probability and magnitude of habitat destroying fires**

Retention of a greater amount of habitat for owls, and protection of all known owl sites, lessens the risk associated with the loss of any particular block of habitat. Refer to the section on fire and fuels for a discussion of the effects of this alternative on fuel profiles and fire occurrence. Effects are intermediate between those described for Alternatives 1 and 2.

CUMULATIVE EFFECTS

Cumulative effects that would be associated with any of the three alternatives are:

1. The effects of projects other than timber harvest.

2. Effects of timber sales already under contract but not yet harvested, and effects of sales which will be sold prior to implementation of these guidelines.

3. Effects of activities on adjacent and intermixed private timberlands.

Projects such as trail construction, road construction, mining activities, ski area development will continue to be planned over the next two years and into the future. Because these projects are not programmatic in nature, their effects cannot be analyzed in a province-wide assessment. The effects of these types of projects in the Sierran province were not identified as a concern in the CASPO Report. Although they will contribute to the overall effects to owl habitat, they are not currently occurring at a scale or intensity to raise province-wide concerns for the owl or its habitat. Such projects will continue to be evaluated in Biological Evaluations which will consider the effects of such projects in light of the information provided in the CASPO Report.

The cumulative effects of timber sale projects likely to proceed prior to implementation of the selected alternative, can be evaluated for 1993 and 1994. These sales have been planned under the CEA process (Appendix B), and therefore will primarily harvest unsuitable owl habitat. For Alternative 2, about 12,700 acres are projected to be harvested yearly under the requirements of the CEA process in 1993 and 1994. About 43 percent of this harvest will occur under even-aged regeneration harvests, and will contribute to several of the factors of concern raised in the CASPO Report. A reduction in large trees, snags, and subsequently in logs, will occur with this harvest. For Alternative 3, about 11,300 acres are projected to be harvested yearly under the requirements of the CEA process in 1993 and 1994. About 42 percent of this harvest will occur

under even-aged regeneration harvests, and will contribute to several of the factors of concern raised in the CASPO Report. A reduction in large trees, snags, and subsequently in logs, will occur with this harvest.

The cumulative effect of these harvests combined with the projected effects of Alternative 2 or Alternative 3, would not be expected to seriously reduce future management options for the owl.

For Alternative 1, it is more difficult to project the exact split between CEA-driven harvests and harvests solely under existing Forest Plan direction, but CEA harvest should be between 11,000 and 13,000 acres per year, given the amount of sale planning that has already occurred under the CEA guidelines. About 44 percent of this harvest will occur under even-aged regeneration harvests, and will contribute to several of the factors of concern raised in the CASPO Report. A reduction in large trees, snags, and subsequently in logs, will occur with this harvest.

The cumulative effects of these harvests, combined with the continuation of effects described in Alternative 1, would potentially lead to a significant effect upon the spotted owl.

The cumulative effects of timber harvest that will occur on private timberlands within the Sierran province was considered by the Technical Team. As stated in the CASPO Report, it is quite difficult to characterize harvest practices on private timberlands as they vary markedly. Nonetheless, the CASPO Report does not recommend any specific guidance for management of private timberlands during this interim period. This would indicate that significant effects to the owl population or to future management options, were not anticipated to occur as a result of the cumulative effects of private timberland harvest during this interim period.

TIMBER

History and Current Condition

The forests of the Sierra Nevada have been affected by western civilization for more than 150 years, with the heaviest impacts occurring in the last 100 years. Impacts include a number of management activities such as mining, logging, sheep grazing, logging associated with the railroads and changes in fire patterns, most notably the suppression of fire since the turn of the century.

a. Mining and Logging

Most of the earliest logging was associated with mining operations, either directly by providing timbers for shoring mine tunnels or fuel for processing of ore, or indirectly by providing housing for employees and locomotive fuel for transport of processed ore. Prior to the railroad, transport of timber depended upon wagons. This restricted the area influenced by harvest to within 20-40 miles of a given mine. In the middle and southern Sierra (generally the Eldorado National Forest and south), most of the mines were located at lower elevations, below Forest Service lands, so most of the heavy logging associated with mining was restricted to lower elevation private lands.

However, within this area there was selective logging of some of the largest, most valuable sugar pines and giant sequoias to exploit the lucrative shake and grape stake markets. In the northern Sierra (generally Tahoe National Forest and north), ore deposits extended into higher elevations and the impact of logging in support of mining was greater on Forest Service lands. In addition, railroad access was more extensive, permitting more intensive logging of a wider area.

The impact of logging associated with mining and the railroad was heaviest on the Tahoe National Forest, affecting half of what is now National Forest Service system land. In general, with the exception of the Truckee Basin, Yuba River Basin and lands immediately adjacent to the Southern Pacific Railroad, logging of National Forest Service system lands was restricted to selective harvest of sugar pine and other high-value trees.

b. Sheep Grazing

Unlike logging, which impacted limited acreage of the Sierra Nevada forests prior to 1900, the entire Sierra range was intensively overgrazed by sheep for decades beginning in the early 1860s. In addition, sheep herders also burned extensive areas to encourage growth of forage, as well as to remove fuel and young trees which served as impediments to movement of the sheep. The combination of these two practices had a profound effect upon herbaceous vegetation and patterns of forest regeneration in the Sierra Nevada. In the absence of competing vegetation, regeneration was rapid and dense when sheep overgrazing and fires ignited by sheep herders were discontinued in the early 1900s.

c. Fire Suppression

Prior to European settlement in the mid-1800s, Sierran mixed-confer forests were characterized by a short-interval, low to moderate severity fire regime. These frequent fires maintained surface fuels at fairly low levels, and kept understories relatively free of trees and other vegetation that could form fuel ladders to carry surface fires into the main canopy, contributing to stand-destroying fires.

This effect of frequent fires, coupled with widespread, intensive sheep grazing after the mid-1800s, probably accounts for the common reports by early observers that the forests of the Sierra Nevada were open and park-like. However, locally intense crown fires affecting small areas (ranging in size from a single tree, or small group of trees, to perhaps several acres) were common and an important influence on stand structure. Crown fires tended to occur where locally-heavy fuel accumulations were present, and provided conditions favorable for regeneration and growth of shade-intolerant and relatively fire-resistant species such as ponderosa pine,

giant sequoia and black oak. The more shade-tolerant and fire-sensitive species such as white fir and incense-cedar regenerated beneath overstory trees as well as in the openings. Periodic fires, however, kept their numbers relatively low, especially in the understory.

The structure and composition of the Sierran mixed-conifer forests have been profoundly affected by the fire exclusion policies begun in the early 1900s. As frequent fires of low intensity ceased to be a dominant ecological force, shade-tolerant and fire-sensitive tree species, especially white fir, proliferated. This fir proliferation was particularly in the small to medium size classes, resulting in multi-storied stands consisting largely of shade-tolerant species. Regeneration of pines and other shade-intolerant species has declined.

The practice of "selective" cutting since the mid-1800s, which has typically involved removal of only the largest and oldest trees from the stand, followed by abundant regeneration, has reinforced the changes in structure and composition brought about by fire exclusion. With fire suppression and selective cutting practices, fuels on the forest floor have accumulated far beyond their normal historic levels. The increased prevalence of white fir in the understory has created hazardous fuel ladders, linking surface fuel to upper canopy layers. Increases not only in quantity, but also in horizontal and vertical continuity of fuels has substantially increased the probability of large-scale, catastrophic, stand-replacing fires.

Other aspects of this subject are discussed in the Fuels section of this analysis.

d. Stand Structure and Composition

All of the management activities discussed previously have had profound effects on the current structure and composition of mixed-conifer stands in the Sierra Nevada. Stands at the turn of the century were characterized by a fairly open structure dominated by very large and very old trees, frequently in excess of 250-350 years old. Although patches of regeneration were present, most stems exceeded 25 inches in dbh. Species composition at the turn of the century was fairly similar to that of today, with perhaps a 10-20 percent decrease in pines, and a concurrent increase in white fir and incense-cedar, as a result of selective logging and fire suppression.

Presettlement species composition may have favored a higher percentage of pine than was found in inventories conducted at the turn of the century, due to the effect of selective removal of the pine, particularly large sugar pine. The greatest change has been in stand structure and spatial distribution. Presettlement stands were less dense and consisted of groups of different-sized trees separated on a landscape basis into a complex array of mostly small, even-aged aggregations (trees of the same size and age) and/or stands representing a wide range of age and size-classes.

The resultant landscape consisted of even-age aggregations separated on a horizontal basis with little vertical diversity within the aggregations. Current stands are characterized by dense, fairly even-aged stands in which most of the larger trees are 80-100 years old. These stands are more complex when viewed vertically, because of the dense understory layers of white fir and incense-cedar, but are much less complex and more homogeneous when viewed on a landscape scale. While overstory species composition, particularly of pines, is similar today to that of the turn of the century, pine regeneration is occurring more infrequently, giving way to dense shade-tolerant fir regeneration which is favored by the practice of selective harvest, fire suppression and maintenance of the very dense stand conditions that currently exist in many parts of the Sierra Nevada today. If these practices continue, future stands would be dominated by shade-tolerant species.

Historical Harvests from Public and Private Lands - Statewide

Total public and private timber harvest in California has been in a downward trend from its historical peak of 6 billion board feet reached in 1955. By 1982, at the bottom of the last recession, harvests had fallen to 2.5 billion board feet. Total public and private harvests rebounded to over 4.7 billion board feet in 1989 before declining again in the current recession. Harvest from National Forests reached a peak of 2.4 billion board

feet in 1968. National Forest harvests then trended downward to a low of 0.9 billion board feet at the bottom of the 1982 recession and rebounded to 2 billion board feet in 1989. For the past decade, National Forests have accounted for about 40 percent of total timber harvests in California.

As displayed in Appendix D, harvest levels fluctuate widely from year to year rather than following a smooth pattern. Year to year variations are influenced primarily by changes in housing markets and general business conditions. Only over the long term do timber inventory and growth levels limit harvests.

Issue: **What are the effects to timber supply?**

****Key Indicator:** **(1) Annual volume produced**

Simple economic effects, for example green and salvage volumes, are discussed in this section. The following figures, and much information throughout this analysis, are based on harvest figures projected by the Forests for the developed alternatives, and are based on predicted budget levels. Forest Plan allowable sale quantities (ASQs) are not used for Alternative 1 (No Action) because budget levels should constrain volumes. However, Forest Plan ASQs are displayed in Appendix D for reference.

In addition, information about the Modoc and Inyo National Forests, and the Lake Tahoe Basin Management Unit, will not be generally displayed in this section. As stated previously, the small amount of owl habitat, and the low number of known owls, means predicted effects from any of the alternatives is likely to be very minor, and would only occur when suitable habitat occurs as inclusions in fringe areas within otherwise unsuitable habitat. Occurrence of this suitable habitat, as discussed in more detail in the Wildlife portion of this section, and in Appendix B, is not typical, and owls on these Forests have not been identified outside of this atypical habitat.

Cautionary information about interpretation of volume and acreages and related tables such as effects to counties and jobs

This volume information should not be interpreted as volume targets. Estimated proportional differences between alternatives should be accurate enough to allow the decision-maker to make a reasoned choice between alternatives. However, absolute accuracy of these figures is not possible due to inherent uncertainties about volume projections. Budgets may be estimated based on requested levels and preliminary budget advice from the Washington Office, but Fiscal Year (FY) 1993 budgets were not certain when this assessment was prepared and FY 94 budgets are even less certain.

Also, when the forest volume predictions were made, based on understood implications of those alternatives, they may have been made assuming application of the action alternatives to the "minimum" standards. Retention of trees in excess of those standards, particularly to ensure better stand health and/or growth, may be applied on some stands on a site-specific basis would result in overall volume reductions.

On the other hand, it is possible some Forests may have overestimated effects of the action alternatives. Some preliminary field tests of marking of stands to CASPO and Modified CEA standards produced surprisingly high volumes, which may not have been completely understood by Forests. The "adaptive management" portion of Alternative 2 could affect volume figures, although it is not possible to determine the magnitude or direction of effects because this provision allows proposals of alternative strategies on limited acreages but does not specify the kinds of proposals that are allowed.

In addition, at the time the volume projections were made, Forests were assuming continuation of current owl calling protocol standards for all alternatives. The Technical Team has clarified direction in this matter, and has stated that implementation of the CASPO strategy based on existing known owl presence, should ensure owl viability. This has resulted in modification of the action alternative to limit future project-related calling. This may increase volumes possible for the action alternatives due to availability of personnel for other duties in

timber sale analysis and preparation and reduce time frames to complete sale preparation. However, it is not possible to project volume increases with any certainty. This increased efficiency could be offset by increased timber stand analysis and data collection needs.

Salvage figures, as will be discussed in more detail in the next section, are inherently uncertain. Wildfires and continuation of the drought-induced insect infestation could shift funds from the green program to salvage. This would change the mix and the value of the trees harvested.

Due to all the uncertainties discussed, it is possible that realized volume figures could vary in either direction. This variation will also be applicable to the Effects to Counties and the Jobs Figures. However as stated, proportionally, the differences between alternatives should be sufficiently accurate to allow the decision maker to make a reasoned choice between alternatives.

Acreage figures, which are cited throughout this document, are projected from volume figures based on Forest generated volume per acre information. Uncertainties inherent in the volume figures consequently also apply to the acreages.

Information on how the volume figures were obtained

The following figures display predicted green and salvage volumes for FYs 1993 and 1994. The green volumes are budget-constrained. In other words, they are based on final FY 93 budgets and projected FY 94 budgets, which may limit the amount of volume that may be harvested. These figures are based on data collected from the Forests. The salvage volumes are not budget-constrained. In other words, it is anticipated that sufficient funds will be available to analyze and prepare salvage timber sales. This assumption is based on funding experienced for the last several years. Salvage figures are also based on data collected from the Forests.

Another factor that should be considered is the split in direction for FY 93. Because this interim guideline decision will happen part way through the fiscal year, some projects in FY 93 will be prepared under the current Cumulative Effects Analysis (CEA) process. In fact, a few projects implemented in early FY 94 (prior to January 1, 1994) will have decisions that were signed in the earlier part of FY 93, and also will be subject to the current CEA process.

FY 94 volumes better reflect the alternatives' effects. It is anticipated that a similar situation will occur when the longer-term strategy decision is made. There will probably be projects prepared under guidelines of the selected alternative that will be implemented in FY 95. It is not possible to predict how much of this shift will occur at this time, particularly as it is unknown what the final strategy will be, however, it is likely that FY 95 timber sale program levels would be similar to program levels in FY 94.

TIMBER HARVEST VOLUMES

Figure 3 - FY 93 Green and Salvage Volumes

	Green Volume (MMBF)			Salvage Volume (MMBF)		
Nat. Forest	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Eldorado	60.0	22.0	22.0	140.0	140.0	140.0
Lassen *	24.0	24.0	24.0	74.0	56.0	56.0
Plumas *	44.6	39.1	39.1	37.0	37.0	37.0
Sequoia	22.0	13.0	13.0	19.0	15.0	15.0
Sierra	40.0	32.0	20.4	35.0	20.0	20.0
Stanislaus*	55.0	26.0	15.2	59.0	50.0	50.0
Tahoe *	35.0	20.0	9.3	20.0	10.0	10.0
Total:	280.6	176.1	143.0	394.0	328.0	328.0

* Throughout this analysis, an asterisk next to the Forest name in a Figure indicates those National Forests which are associated with timber-dependent communities. Refer to the Effects to Counties portion of this analysis for details.

FY 94 Green and Salvage Volumes

	Green Volume (MMBF)			Salvage Volume (MMBF)		
Nat. Forest	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Eldorado	141.9	141.9	141.9	10.0	7.5	7.5
Lassen *	46.0	36.6	13.4	38.0	10.5	10.5
Plumas *	44.6	39.1	12.9	37.0	10.5	10.5
Sequoia	22.0	10.0	5.3	19.0	11.3	11.3
Sierra	47.5	47.5	10.0	35.0	15.0	15.0
Stanislaus*	55.0	20.5	8.8	59.0	50.0	50.0
Tahoe *	35.0	20.0	2.6	20.0	7.5	7.5
Total:	392.0	315.6	194.9	218.0	112.3	112.3

FY 93 and FY 94 Multiproduct Volumes

Yearly Program (MMBF)

Nat. Forest	Alt. 1	Alt. 2	Alt. 3
Eldorado	-0-	-0-	-0-
Lassen *	16.0	5.0	12.0
Plumas *	9.0	9.0	9.0
Sequoia	3.0	3.0	3.0
Sierra	-0-	-0-	-0-
Stanislaus*	5.0	5.0	5.0
Tahoe *	11.0	11.0	11.0
Total:	44.0	33.0	40.0

Multiproduct Discussion

Multiproduct timber sales are timber sales which consist of variable-sized wood material which can be processed into several end products. The typical multiproduct sale consists of some trees greater than or equal to 12 inches dbh, limbs and tops included, and trees less than 12 inches dbh. In these sales, the boles from the larger trees will be processed into sawtimber while the smaller trees, limbs and tops will be processed into chips to be used as pulp or in co-generation plants.

The Forest projected volume input indicates the alternatives are not expected to affect the multiproduct projected program except on the Lassen National Forest, which has a more developed program (more experience with the program) than most of the other Forests. On the Lassen National Forest, the higher volume predicted in Alternative 1 is a result of more regeneration harvests and less restrictive Standards and Guidelines, and the higher volume predicted in Alternative 3 is a result of more larger trees available and a good Forest understanding of the process, which increases the efficiency of analyzing and selling multiproduct timber sales.

The spread in predicted volume on the Lassen National Forest may be more realistic than the other Forests due to the Lassen's good familarity with multiproduct timber sales. However, due to the relatively small volume affected, these figures are expected to be accurate enough to allow the decision-maker to make an informed choice. Although volume may not be a critical factor, and in fact, there may not be a great difference between alternatives, these sales are still important. Multiproduct sales have positive effects on reducing the possibility of stand destroying wildfires as they eliminate much of the ladder fuels which are one of the major problems in owl habitat. Refer to the Fuels discussion for more information.

Salvage Discussion

FY 94 salvage figures for Alternatives 2 and 3 reflect that the salvage guidelines are the same. The FY 94 salvage figures for all three alternatives are primarily based on salvage of insect-killed trees and do not include wildfires. The Eldorado National Forest is an exception. Their entire FY 93 program

is projected from harvest on the Cleveland Wildfire area. (Also, refer to Appendix B - Technical Team questions and answers for more information on this project.) If wildfires occur, the balance between salvage and green would probably change, with more of an emphasis on harvest of dead trees.

The previous figure, including the No Action Alternative, considers salvage of as much of the drought-induced mortality as is feasible economically, physically and administratively. Salvage would be administratively prohibited from areas such as wilderness and research natural areas. In addition, some of the mortality is too scattered, inaccessible, small, decayed or concentrated in low value species to physically or economically support harvest.

Alternative 1 (No Action), Forest Plan Standards and Guidelines require a variety of levels of kinds of snags to be retained. Refer to Appendix B. However, the minimum snag retention required is generally 1.5 snags per acre within the capable, available and suitable landbase.

Alternatives 2 and 3 require retention of 4 to 8 of the largest snags per acre. Averaging snag levels on a stand basis is permitted. Salvage in Protected Activity Centers will not be allowed at all, unless a biological evaluation expressly finds that this would clearly benefit owl habitat. Occurrences of salvage in PACs is expected to be so unusual, that for the purposes of estimates of salvage volumes, it is considered to be not allowed.

The retention of up to eight of the largest snags per acre, where salvage is allowed, will eliminate salvage opportunities in some areas, particularly areas with relatively light drought-induced insect mortality. Areas with severe mortality, and extensive areas of moderate to severe wildfires will still have salvage opportunities. However, as stated, the extent of these opportunities is very difficult to predict.

Salvage volumes are always tentative because of the unpredictability of wildfire and drought-related mortality. There is currently severe mortality, which is drought-induced, occurring throughout the Sierra. The six year drought has weakened trees and made them susceptible to insect attack. In previous years, these insect populations have primarily attacked trees already weakened by the drought. Overstocking has also made stands more susceptible to insect attack.

Now insect populations have built up to levels where they are successfully attacking and killing healthy trees, especially in overstocked stands. Throughout much of the Sierra, particularly the southern half, insect mortality is concentrated primarily in the pine, occurring as scattered individuals or small groups. In northwestern California, there is very heavy tree mortality in white fir in the mixed conifer type. This mortality occurs primarily in components of these stands where fire has replaced pine and is off site. On the Plumas, Lassen and Modoc National Forests, defoliator populations are increasing and causing moderate to heavy levels of damage. Species causing this damage include: the Modoc budworm, the white fir sawfly, and the Douglas-fir tussock moth.

In the northern Sierra, especially the Lassen and Plumas National Forests, insect populations are reaching epidemic proportions. Much of this mortality is occurring in eastside pine type where white fir has encroached, resulting in heavily overstocked stands susceptible to the combined effects of drought and insects. Because the eastside type is outside the range of the owl, the full spectrum of management options will be available in this cover type. Insect infestations are expected to continue at least as long as drought-induced stress conditions persist, often 2-3 years after the resumption of "normal" rainfall patterns. A discussion of dead and dying timber in relation to fuels and wildfire is found in the Fuels discussion.

****Key Indicator:** **(2) Effects to products**

Virtually all timber harvested in California is manufactured into lumber. Less than one percent is exported internationally as logs and this is exclusively from private lands, as export of unprocessed logs from public lands is prohibited. The lumber and timber products manufactured from timber harvested off the Sierran National Forests is dependent upon the size, quality (number and size of knots and amount of decay) and species of the trees and the value of the products produced varies accordingly.

Figure 4 - Value of Manufactured Products

Product	Ponderosa Pine	Sugar Pine	Douglas-fir	White Fir
Selects	$940/MBF	$1500/MBF	$735/MBF	-- *
Molding	$940/MBF	$1150/MBF	-- *	$567/MBF
No. 2 Shop	$369/MBF	$435/MBF	$735/MBF	$567/MBF
No. 3 Shop	$213/MBF	$435/MBF	$735/MBF	$567/MBF
Common	-- *	$290/MBF	-- *	-- *
Standard & Better	$183/MBF	-- *	-- *	-- *
Utility & Economy	$ 93/MBF	$105/MBF	$122/MBF	$118/MBF
Structural/hvy framing	-- *	-- *	$304/MBF	$267/MBF
Light framing	-- *	-- *	$233/MBF	$267/MBF
Veneer	-- *	-- *	$482/MBF	-- *

* Product not manufactured or price not available. Ponderosa pine prices 1982 base from Ernst and Pong (1985); sugar pine prices base 1987 from Willits and Fahey (1991); Douglas-fir and true fir prices base 1989 from Haynes and Fight (1992).

In general, the most valuable products - the selects, moldings, veneer and high grade shop - are obtained primarily from logs of high grade (those with few and small knots and little or no defect). These high grade logs are obtained almost exclusively from large-diameter (generally >30 inches dbh), older trees which have had time for the limbs to die and fall off a substantial portion of their bole, producing relatively knot-free logs. Structural and heavy framing lumber (2 X 10 and laminated stock) are also obtained only from larger trees.

The lower valued products such as the utility and economy grades are obtained from lower grade, smaller logs. These products are usually obtained from the top logs of large trees or from smaller trees where limb-pruning has not occurred and knot size and number makes them unsuitable for higher value products. Thus, log value increases in direct proportion to log size due to the higher value of products manufactured from the larger diameter logs. Log value also increases with log grade, which again is generally directly related to log size and affects product manufacturing. For example, a 10 inch diameter, Grade 5 sugar pine log has a value of $200 per thousand board feet (r.ıbf) lumber tally versus a 40 inch diameter, Grade 1 sugar pine log which is worth $900 per MBF lumber tally (Willits and Fahey, 1991).

The efficiency of lumber manufacturing is also directly related to log size. As log diameter decreases below 20 inches, the percent of a sawn log that actually becomes "boards" rather than chips, a "waste product" decreases dramatically. This is due in part to sawmill efficiency, but is more a function of the mechanics of sawing round logs into rectangular boards. Using ponderosa pine as an example, from a 40 inch diameter log, 75% becomes green lumber, 10% sawdust and 15% chips. From a 10 inch diamter log, only 55% becomes green lumber, 8% sawdust and chips now account for 38% of the log (Ernst and Pong, 1985).

An inspection of volume distribution by tree size from the most current inventory on affected National Forests suggests that aproximately 50% of the volume in Selected and Other strata is contained in trees 26 inches dbh and larger (Tree, Basal Area, and Volume Relationships for National Forests Within the Range of the California Spotted Owl; US Forest Service, Pacific Southwest Region, April 1992).

Alternative 1 - No Action

Under this alternative, a full range of manufactured wood products would continue to be provided from the Sierran forests, in particular the high value moldings, veneer and select lumber. Timber harvest would be maintained across the full spectrum of diameters, and continue to provide large dimension structural and heavy framing lumber. Based on recent experience, an estimated 70% of the harvest volume would be contained in logs with scaling diameters of 20 inches or larger (personal communication with Bud Lacey, Region 5 Southern Quality Control Officer). Price fluctuations would continue historic trends influenced by economic cycles and new housing starts. Even with selection of this alternative, lumber prices would be expected to increase somewhat due to supply reduction effects caused by implementation of the northern spotted owl restrictions in Oregon, Washington and Northern California.

Alternative 2 - CASPO

Adoption of the CASPO recommendations would have important consequences on the range of manufactured products provided from Sierran Forests. The basal area retention of largest trees guideline (40% for Selected, 30% for Other strata) confines most of the potential timber harvest to trees less than 26 inches dbh (Tree, Basal Area, and Volume Relationships for National Forests Within the Range of the California Spotted Owl; US Forest Service, Pacific Southwest Region, April 1992). Less than 10% of the potential harvest volume would come from trees between 26 inches and 29 inches dbh, and with only minor exceptions there would be no harvest at all of trees larger than 29 inches dbh. Less than 20% of the harvest volume would be expected to come from logs with a scaling diameter of 20 inches or larger. Compared to Alternative 1, log grade, log value and sawing efficiency would all decline greatly. Products would be manufactured mostly from 6 inch to 20 inch diameter logs, resulting in primarily lower valued products such as utility and economy lumber, 2 X 4 studs from the firs and pallet material. A higher percentage of the logs would end up as chips or hog fuel. 1/

The availability of high value products such as veneer, molding, select, structural and heavy framing lumber which is dependent upon larger diameter, high grade trees, would be greatly reduced. This shortfall may be compensated for by increased importation from other regions of the United States and from foreign sources. Price increases for these shortage products would be substantial. Mills which specialize in products such as veneer and moldings or are dependent upon processing only large diameter logs would be adversely affected by selection of this alternative. As harvest gradually shifts from larger, high grade trees to thinning and harvest of smaller diameter, lower grade stands, these mills will be affected anyway. However, Alternative 2 will implement these changes immediately with no opportunity for gradual phase-in and retooling.

1/ Hog fuel refers to chips produced from the whole tree. These chips are used for fuel in wood-fired energy plants and may be produced from the tree bole, top, limbs or bark.

Alternative 3 - Modified CEA Process

Adoption of the CEA process as modified would have an even greater impact than Alternative 2 on the availability of manufactured wood products, particularly high value products such as veneers or molding. Within owl use areas, there would be little or no harvest of timber at all as few would contain "excess" habitat. Within the rest of the mixed conifer and true fir strata, basal area restrictions would again result in little harvest of trees larger than 25 inches dbh. Therefore, not only would the availability of products derived from larger diameter, high grade trees be greatly reduced, but the total availability of all products would be reduced due to the smaller landbase from which timber harvest would be permitted. Part of the shortfall could be made up by concentrating harvest within the eastside pine on the northern Sierran National Forests, or from reliance on foreign and domestic imports. However, the total impact on price increases due to an even more constrained supply would probably be greatest under this alternative. Mill impacts will be similar to Alternative 2, although all mills would be affected by a general reduction in timber supply.

This discussion also relates to the receipts to counties section of this document. As stated in that discussion, county receipts for Alternatives 2 and 3 are lower not just because volumes are lower, but also because the volume is less valuable.

****Key Indicator: (3) Timber sale cost efficiency**

There are many factors which influence timber sale cost efficiency. Timber volume, value (influenced by species and diameter), stand location, harvest method (tractor versus cable versus helicopter), access, marking and cruising techniques and methods, overhead costs, environmental analysis costs such as biological and silvicultural review, and other factors. It is not possible to develop an average current or "Forest Plan" cost for sale preparation and sale value which is meaningful for purposes of this analysis. Although average sale preparation costs do vary by National Forest, most of the contributing cost factors are extremely variable, and no conclusions could be drawn which would be useful to compare one alternative to another, with two exceptions.

Implementation of the action alternatives (Alternatives 2 and 3) would include a much reduced owl survey program. When the National Forests provided their sale preparation cost figures, they did not consider cost savings generated by a limited owl survey program. When contacted to analyze this variable, the Forests were not able to estimate with any accuracy volume increases, however, they did estimate a reduction in sale preparation cost savings of $6-$8 per mbf if owl survey requirements were greatly reduced. However, the monetary savings are not as important as Forest Service staffing, scheduling and work coordination improvements that could result in increased efficiency.

Therefore, Alternatives 2 and 3 would be less costly to implement from that standpoint, than the No Action Alternative which would still necessitate implementation of the current owl survey protocol. Forests which have little "pipeline volume" (sales prepared in advance of scheduled sale date) would realize the greatest benefits. Forests which have more pipeline volume, have already substantially completed their owl survey work, and would not realize nearly as much cost savings.

The other exception is the higher per acre data collection costs of Alternatives 2 and 3. Preliminary estimates by all affected Forests, and more detailed estimates (based on field trials) are that per acre timber sale preparation costs could double, primarily due to increased timber stand information needed to implement CASPO, or elements of CASPO (Alternative 3). There are very likely efficiencies that may be realized in stand examination, data entry and interpretation, and related tasks, but it is unlikely these efficiencies would be realized immediately. It would take time for employees to learn and implement a new system, and even Alternative 3, which in part is currently being implemented, has new modifications which would take time to learn.

However, some cost factors do vary by acres and harvest prescription. In so far as the alternatives vary by acres and harvest prescription, comparisons can be made, although absolute cost differences are not obtainable.

The following cost factors vary proportionally to numbers of acres in the sale or analysis area: marking and cruising costs and environmental analysis costs. It is more cost efficient to produce a given amount of volume from a smaller number of acres, than from a greater number of acres. It costs more for an archaeologist, silviculturist or timber cruiser to examine or lay out more acres. It also costs more for a biologist to examine more acres, however, this statement considers biological analysis only and not the savings realized by limiting owl surveys.

Clearcuts, seed-tree cuts and shelterwood seed cuts are less complex to prescribe and mark than other prescriptions and therefore, these regeneration harvests are less time-consuming and thus cheaper to prepare. However, with Regional reductions in acres of traditional application of these prescriptions, costs have risen. For example, five years ago a traditional bare-ground clearcut may have been prescribed, but today this prescription is used less frequently, and is currently being replaced about 20 percent of the time by "regeneration mosaics." Current projections are that modified clearcuts will replace bare-ground clearcuts about 80 percent of the time. Refer to the silvicultural systems discussion later in this section for information on this topic.

These types of modifications have increased analysis, inventory, prescription and marking costs. Therefore, there is no longer as large a cost savings by prescribing one type of harvest method over another, although regeneration harvests are still cheaper to mark and cruise than are partial harvests.

Volume per acre figures were provided by the individual Forests, excluding the Modoc, the Inyo and the Lake Tahoe Basin Management Unit. They include only commercial green and salvage sales, and do not include biomass or multiproduct figures, which are not anticipated to change substantially by alternative. To an even greater degree than the total volume figures, the volume per acre figures are variable, and effects on the ground will not be consistent. However, broad effects, as quantified below, will serve to allow the decision maker to make an informed choice between alternatives.

Green Volume Per Acre

Alternative 1 harvests 15.0 MBF/acre.
Alternative 2 harvests 9.6 MBF/acre.
Alternative 3 harvests 9.1 MBF/acre.

Salvage Volume Per Acre

Alternative 1 harvests 2.5 MBF/acre.
Alternative 2 harvests 1.6 MBF/acre.
Alternative 3 harvests 1.6 MBF/acre.

For illustrative purposes for green timber sales, if Alternative 1 is assumed to be 100% efficient, then Alternative 2 is 64% efficient and Alternative 3 is 61% efficient. These figures are not absolute, but in general Alternative 1, which allows a full range of harvest prescriptions, is more efficient than Alternative 2 which primarily allows a form of "thinning from below" for most of the mixed conifer zone and requires more acres to be entered to obtain the same volume. Alternative 3 is harder to compare as this process (when applied) generally allows no harvest within owl use areas (which are 2,000-2,500 acres), and applies CASPO recommendations outside of owl use areas, within Other strata. Therefore, CASPO efficiencies generally apply for stands that can be entered and costs should be similar for Alternatives 2 and 3.

For salvage timber sales, if Alternative 1 is assumed to be 100% efficient, then Alternatives 2 and 3 are both 64% efficient. This is because more acres need to be entered to achieve equal volumes, due to the restrictions in Alternatives 2 and 3 precluding harvest of the largest snags.

Biomass

Issue: **What are the economic effects?**

****Key Indicator:** **(1) Related direct effects to employment**

Base volumes have no meaning in the following biomass discussion as potential biomass production is related primarily to industrial capacity rather than environmental or regulatory constraints. Therefore, these figures are additional financial and job-related effects to either scenerio.

Biomass in this context is defined as whole tree removal of boles, tops and limbs. Biomass products are generally pulp-quality chips or small sawlogs, or as hog fuel to supply electricity-generating plants in the Sierra Nevada. Currently the energy wood market in the Sierra Nevada uses approximately 8 million bone-dry tons (bdts) per year. About 40 percent of that is provided by sawmill residue. Sawmill contributions could drop to 15 percent with decreased sawmill production in Alternatives 2 and 3 which could increase the capacity for biomass products from small trees by 46,000 acres per year. There is much variation in the prices paid for biomass. In fact, some biomass material has so little value, and/or costs to cut and transport the material are so high, that these products are removed by service contracts. In these contracts, the Forest Service pays for its removal. Nevertheless, a survey of recent biomass projects displays that a "stumpage" price of $2.50 a green ton is reasonable. Electricity plants commonly pay upwards of $30 per bdt, however this value added is due to labor, product handling and transportation.

Twenty-five green tons per acre, at $2.50 a ton over 46,000 acres, translates into $2,875,000 for the Sierran Forests. This is an increase over current capacity, and not an absolute figure. However, it does represent some compensating value which will increase jobs and receipts to counties. The acres and receipts should be divided fairly evenly throughout the Sierran Forests, with the following exeptions: the Sequoia and Sierra National Forests are farther away from biomass plants than the more northern Sierran Forests, and have competition from other biomass sources such as agricultural waste products. Therefore, the acres would be distributed more heavily in the northern Sierran Forests.

Comparing added biomass production instead of absolute figures is a reasonable approach to compare alternatives because at least in one of the action alternatives, there is potential to increase production over existing levels to account for a larger market. Alternative 2 suitable acres are approximately 96% of the Forest Plan and Alternative 2 allows harvest on well-stocked acres. (Refer to Appendix D.) In other words, this Alternative has sufficient suitable acres to reasonably handle an increased biomass production program and stocking on suitable acres, while varying, can be heavy, so this increased market can probably be met.

On the other hand, Alternative 3 has approximately 64% the "available" acres of the Forest Plan Alternative. (This information is available in Appendix D.) This reduced "availability" is in reference to lands available for management under the CEA process, and should not be confused with NFMA availability definitions. The reduced acreage is a result of the typical elimination of harvest within owl use areas. Although exceptions can be made if a clear benefit to the owl from harvests can be demonstrated, for the purposes of this analysis, zero entry is assumed.

Although there may be a market for biomass with the Modified CEA Alternative, capacity to produce biomass on 46,000 acres may be somewhat constrained due to more limited suitable ground. The most densely stocked stands usually cannot be entered, and biomass is more salable when some small sawtimber is included in multiproduct sales. CEA constraints usually limit timber sales to stands that are

not well stocked, or are very young. These factors decrease multiproduct opportunities. It is difficult to predict with certainty how much less biomass Alternative 3 could produce, but the combination of more limited acres, acres of poorer stocking and less multiproduct opportunities could limit feasible biomass acres to sixty percent of that of Alternative 2.

Production rates for biomass are estimated to be about 1.25 acres a person-day. These jobs are spread proportionally to acres in Figure 5. Because rounding of figures does not apply well to labor, all employment figures are rounded up, although this may overestimate employment somewhat.

The following figure displays estimated additional jobs and income (which will contribute to receipts to counties) created by the reduction of mill production for the action alternatives, because for the interim period, the biomass market is capacity limited. A reduction in sawmill residue means a potential increase in the demand for biomass material from small trees. For this comparison, Alternative 1 can be considered to be a baseline, or zero, although, there is currently a biomass program throughout the Sierra, and current income and jobs are being generated. Finally, although most employment-related issues are discussed later in this analysis, both biomass income and jobs are discussed here for clarity and to avoid repetition of assumptions.

Figure 5 - Estimated Additional Biomass and Related Jobs Provided

	Est. Acres		Value per Acre	Total Value (thousands $)		Total Jobs	
National Forest	Alt. 2	Alt. 3	($)	Alt. 2	Alt. 3	Alt. 2	Alt. 3
Eldorado	6,134	3,680	75	460	276	20	12
Lassen	6,134	3,680	75	460	276	20	12
Plumas *	6,134	3,680	75	460	276	20	12
Sequoia	4,600	2,760	75	345	207	15	9
Sierra	4,600	2,760	75	345	207	15	9
Stanislaus *	6,134	3,680	75	460	276	20	12
Tahoe	6,134	3,680	75	460	276	20	12
Modoc * **	6,134	3,680	75	460	276	20	12
Total:	46,000	27,600	--	3,450	2,070	147*	88*

* Total does not account for "rounding up" of employment figures. Total may be more realistic than individual Forest figures.

** The Modoc is displayed here as this Forest will experience increased biomass activity.

County Affected Environment

****Key Indicator: (2) Effects to counties**

There are differences between the amount the individual National Forests contribute to county funds, and there are differences between the financial and employment situations in the counties themselves. The following communities are those with mills, at least 10 percent timber industry related employment, and at least 50 percent of log supply from the National Forests. These communities are considered "timber dependent." This information is compiled and maintained by the Regional Office Land Management Planning Staff.

Bieber, Nubieber, Susanville: Lassen County
Auberry: Fresno County
Canby, Alturas, Cedarville area: Modoc County
Chester, Quincy: Plumas County
Loyalton: Sierra County
Northfork: Madera County

Also considered as "timber dependent" are counties where National Forest timber are a relatively high proportion of local road or school budgets (approximately 10 percent or more). Alpine County receipts (also Modoc, Lassen, Plumas and Sierra Counties) meets this criteria.

The following Counties have unemployment at or above 10 percent:

Modoc, Lassen, Plumas, Sierra, Yuba, Calaveras, Tuolumne, Madera, Mono, Inyo, Tulare, and Kern.

Plumas, Yuba and Tulare Counties have unemployment rates above 15 Percent. Unemployment figures are based on State of California Employment Development Department, April 1992 data.

The following counties have both timber-dependent communities and unemployment of 10 percent or more or have National Forest receipts which contribute a high percentage of local road or school budgets: Alpine, Modoc, Plumas, Lassen, Sierra.

The following are the primary National Forest of these counties.

Alpine: Stanislaus National Forest
Modoc: Modoc National Forest
Plumas: Plumas National Forest
Lassen: Lassen National Forest
Sierra: Tahoe National Forest

Therefore, although receipts to counties, and employment in the timber industry are important to all affected counties, they are most critical in the Modoc, Stanislaus, Plumas, Lassen and Tahoe National Forests. As has been stated previously, it is unlikely any of the alternatives would produce a large change in outputs, and related receipts to counties, on the Modoc National Forest.

Changes in the management of the National Forests have effects on people and the families, groups, and communities to which they belong. Social impacts are those which change communities, institutions, and social and cultural conditions (FSH 1909.17/30.5).

The social effects expected from the alternatives are primarily those which flow directly and indirectly from economic changes in the wood products and forestry economic sector. Changes in employment,

wages, and the viability of firms has immediate and long-term effects on individuals, families, and communities.

The social ramifications are greater than the numerical descriptors. As stated, the effects are particularly important in Alpine, Modoc, Plumas, Lassen and Sierra Counties. These communities are where most of the social and economic impacts of the alternatives will be experienced. However, actual effects to Modoc county may be small, as there is little owl habitat within the Modoc National Forest.

Effects to Counties

Effects experienced in Sierran counties, particularly timber dependent counties, should not be different in type than effects predicted in timber dependent communities in Oregon and Washington (although the magnitude of effects will be less due to reduced duration of the interim guidelines and because the action alternatives allow more harvest relative to the No Action Alternative than did the northern spotted owl guidelines). Therefore, some of the following information is excerpted from the Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests, and while applicable, should be interpreted while considering the differences in magnitude and duration of effects.

The wood products economy has always been a volatile economic sector, and it responds sharply to downturns and upswings in the national economy. The 1980s were a decade of major change in this economic sector, partly due to market forces triggered by changes in the larger economy, and partly due to the widespread increase in the use of technology and automation in wood products manufacturing.

Current volume data (refer to Appendix D) displays volumes that approach Forest Plan ASQs, but a high proportion has been salvage. As previously discussed, in FYs 93 and 94, budgets will constrain the green harvest levels for all three alternatives, including No Action.

The following figures are related to timber volume (refer to Figure 3), but are not directly proportional. Alternatives 2 (CASPO) and 3 (Modified CEA) produce lower value products, and this produces lower receipts to counties.

Figure 6 - Receipts to Counties

County Receipts ($)-1/

Nat. Forest	Weighted Avg. Value ($)-2/	Alt. 1-2/	Alt. 2-3/	Alt. 3-3/
Eldorado	95/MBF	4,180,000	3,143,000	3,143,000
Lassen *	103/MBF	2,755,250	1,501,000	1,401,000
Plumas *	67/MBF	1,601,300	1,024,000	837,000
Sequoia	75/MBF	825,000	441,000	403,000
Sierra	93/MBF	1,832,000	1,132,000	646,000
Stanisalus*	81/MBF	2,410,000	1,348,000	1,153,000
Tahoe *	79/MBF	1,304,000	668,000	431,000
Total:	N/A	14,907,550	9,257,000	8,014,000

1/ County Receipts - In accordance with the Forest Reserve Revenue Act, 25 percent of the qualifying gross annual timber sale receipts are returned to the counties on the basis of the amount of National Forest acreage within the county. Under California law, one-half of the payment must be used for schools and the other one-half for roads. The payment generally does not come out to be exactly 25 percent of the total revenues shown in the TSPIRS report because not all revenues qualify for distribution to counties (i.e. interest, penalties and associated changes) and because of accounting differences between purchaser road credits earned versus charges. In recent years, differences in accounting for purchaser road credits, combined with changes in the road program have been the largest factors resulting in county payment exceeding 25 percent of TSPIRS revenues on most forests. County receipts do not vary in direct proportion to volume. Different timber sales have different costs and values associated. Therefore, alternatives that direct harvest in different locations, for different species, or different sized-timber will produce different valued timber sales. The value of the sales is what affects county receipts. Volumes are for green, salvage and multi product for FYs 93 and 94 divided by two. Figures are rounded to nearest 1,000 dollars.

2/ Weighted average green and salvage values per MBF were completed from sales during the period 1989-1991. These unit values were applied to volumes estimated for the No Action Alternative to estimated returns to the U.S. Treasury and the 25 percent share for Counties.

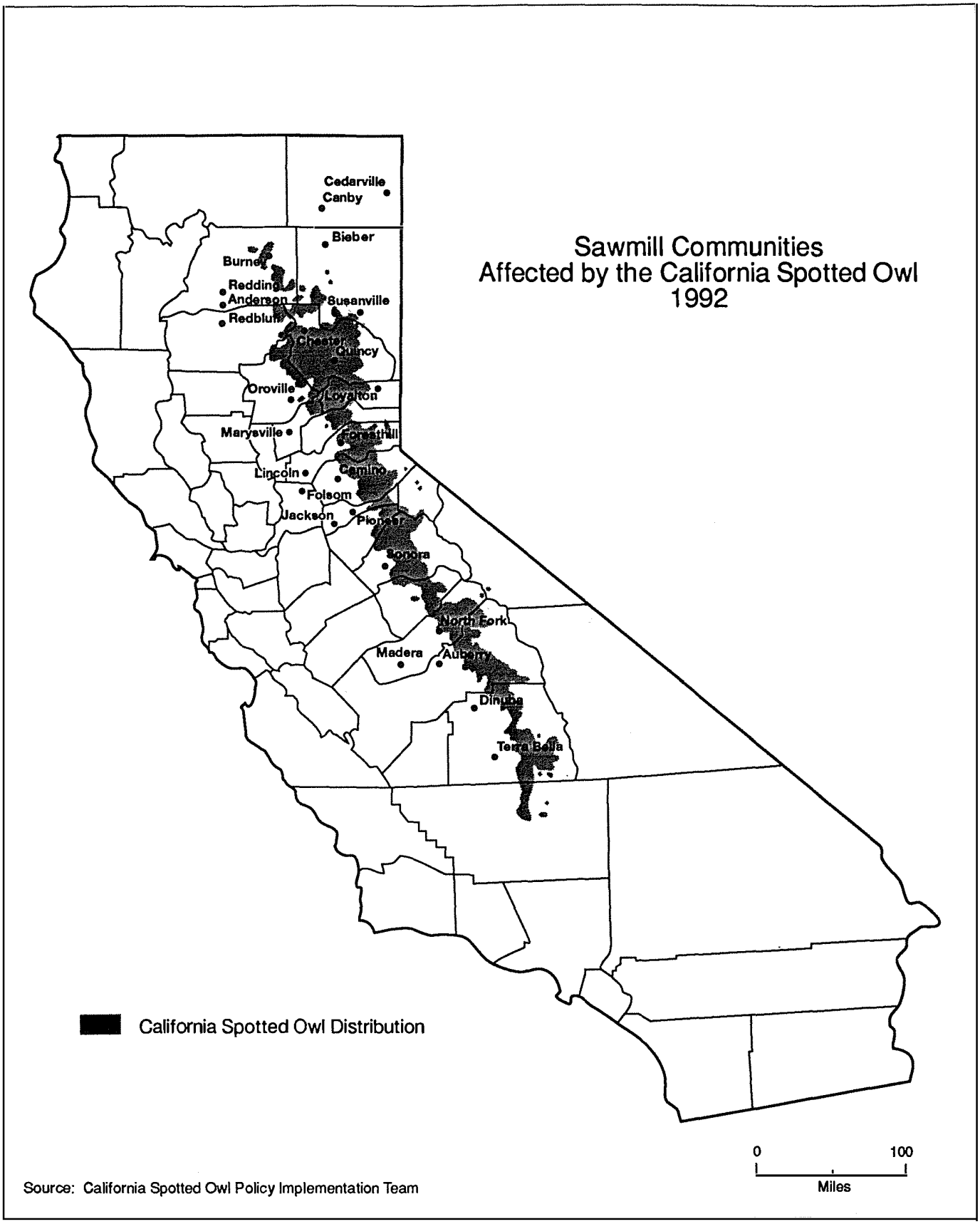
3/ Average county receipts per MBF from Alternative 1 were reduced an average of 15 percent due to lower expected stumpage value based upon smaller log diameters and resulting lower product value.

Effects to Employment

Economic models predict that for harvesting and processing of one million board feet, there are between 4 and 7 jobs in the logging and sawmilling industries and between 8 and 20 local jobs when indirect effects are included. Figure 7 displays both direct and indirect jobs associated with each million board feet produced per Forest. The variation in logging and sawmilling is due to the technology employed and the types of products produced. The variation in indirect jobs varies primarily with the size and integration of the local economy. Refer to the project files for background information on this subject.

Also, refer to the "Timber Sale Program Annual Report, Pacific Southwest Region, Fiscal Year 1991" - (available in the analysis files). Jobs are averaged for Fiscal Years 89-91.

It is not possible to predict exactly where job loss would occur, however, Map 4 displays location of communities with sawmills which are within the range of the owl or may be affected by a change in management of those lands.



Source: California Spotted Owl Policy Implementation Team

Map 4

For Figure 7 - Jobs, numbers are averaged for FY 93 and 94 and the multiplier (total volume) includes green, salvage and multiproduct volumes. As discussed previously, there will probably be carryover effects in FY 95. FY 95 effects however, are likely to be closer to the FY 94 figures than the average of FY 93 and 94.

Figure 7 - Jobs

Commercial Jobs 1/

Nat. Forest	Jobs/ MMBF	Alt. 1	Alt. 2-2/	Alt. 3-2/
Eldorado	12.0	2,112	1,588	1,588
Lassen *	9.0	963	525	490
Plumas *	11.5	1,231	703	575
Sequoia	12.0	528	283	258
Sierra	12.0	946	584	344
Stanislaus *	6.5	774	433	371
Tahoe *	11.5	760	389	252
Total:	N/A	7,314	4,505	3,868

1/ The employment estimates include jobs that are directly and indirectly attributable to timber harvest, as well as those induced by increased economic activity at the local level. These represent 3-year averages for FYs 1989-1991. Volumes are to for green, salvage and multi product divided by two.

2/ Refer to the Timber Sale Program Annual Reports, Pacific Southwest Region, Fiscal Years 1989-1991. Employment estimates per MBF harvested were reduced by 15 percent in Alternatives 2 and 3 to account for smaller product size which results in reduced jobs associated with manufacturing.

Income in local economies, including salaries, property and proprietary income, will change in proportion to estimated changes in local employment. Local income per job is estimated at about $43,000.

Social and Community Effects

Robert G. Lee has written about the social and community effects of implementing the ISC strategy (Lee 1990b) and some of the effects of the interim guidelines alternatives may be similar in kind, although less severe in intensity. ISC is a long-term strategy resulting in significant reductions in timber outputs (75%) over a ten year plus period, while the interim guidelines for the California spotted owl are proposed for only two years, and both action alternatives have significantly lessened effects (27-39% reduction in outputs).

Changes in timber harvest level also act as a surrogate for other measures of economic development in the National Forests (such as mining, developed recreation, and energy development), and as a measure of the level of other forest management activities (such as road construction, tree planting, and vegetation management). Although it is possible that some revenue-generating activities would increase as a result of a reduction in harvest levels, many activities, such as mining, are independent of timber harvest. Other activities, such as recreation, are often more dependent on Forest location in relation to large population centers, than in the forest condition per se. There is a lack of data supporting the concept that economically significant activities in the National Forests will increase when timber harvests decline.

Similarly, none of the social impacts linked to the economic activity of people or communities will be minimized because of declining timber harvests. Beliefs in the widespread sustenance of currently timber-based communities with non-consumptive forest activities and recreation are not well founded. Of the primary affected persons, loggers are more geographically mobile than others in timber-dependent communities (Lee 1990b: 12-14). Mill workers are manufacturing workers in a highly cyclical industry and have developed a variety of ways of "riding out" hard times. Long-term workers usually have built strong ties with one mill and one town. Home ownership and family tie them to communities (Lee 1990b: 14-16).

Local business and service owners provide the core of timber-dependent communities, providing much of the community's leadership. They are rooted in the town, tied to communities by the ownership and investment in homes and businesses (Lee 1990b: 16-18).

Lee (1990b) notes four causes of social and cultural disruption in current proposals and the policy dispute about spotted owl habitat management. Along with job losses, he sees impacts from the loss of trust of a continuation of Federally-assured timber supplies, the emergence of open conflict over cultural values, and the negative stereotyping of the people of the timber industry and timber-dependent communities.

Harvest levels on the Sierran National Forests have been in decline, and implementation of the No Action Alternative is still below harvest levels experienced historically. (Refer to Appendix D.) However, both action alternatives produce lower timber harvest levels than the No Action Alternative, which affects the local community. These effects are felt most in the timber-dependent communities, as these communities often have limited options for other employment or income generation. This negatively affects the community's ability to provide services, the ability to retain a skilled work force, and the quality of life that will attract new industries and recreational visitors.

A two year period of reduced harvest is within normal cyclical harvest cycles and general economic fluctuations. However, the CEA process reduced harvest levels last year and strained community and industry finances. Thus, current reductions in harvest (which are projected to be greater with the action alternatives), coupled with uncertainty about the longer-term strategy, could negate the positive effects of the limited time period of the interim guidelines.

Effects of Job Loss

As displayed in Figure 7, the alternatives produce different employment levels in the timber industry. It is likely that some individuals could lose their jobs if any alternative is selected, including No Action, although effects would be greater with the action alternatives. Whether this job loss will be permanent or temporary is unknown and is in part dependent upon the longer-term owl management strategy, the condition of the economy in general, and potential price increases in timber due to restricted supply. The following discussion focuses on negative effects of job loss. Not all effects will be experienced by all individuals who lose a job, and of those effects experienced, the severity is variable. Some individuals and families cope well with job loss while others do not.

There is not a great likelihood that other employment, particularly in the timber-dependent communities, will be available in the short term. Employment that is available will be likely to have lower wages, and it is possible that both spouses will need to work, where currently families can survive with just one paycheck.

Stress resulting from job losses can have negative consequences for the individual and community. Stress caused by job loss can increase incidences of depression and this could increase the use of mental health services. The effects of job loss, or reductions in working hours can raise incidences of family abuse, substance abuse and cause increased demand for medical services. The reported incidences of heart trouble, hypertension, bone and joint ailments, and chronic headaches all increase during periods of economic instability (D'Arcy and Siddique 1985). When coupled with stress originating from negative stereotyping of wood products workers, some individuals may suffer from a loss of self-esteem. (Lifton and Olson 1976; Luchterhand 1971)

Lee also presents the effects of the loss of trust in Federal timber supplies, the emergence of class conflict, and negative stereotyping. Each factor can cause an emotional impact, and all have the potential to undermine individual and community efforts to successfully adapt to the changes thrust on timber-dependent communities.

The effects of implementing Alternatives 2 or 3 will be lessened by the short time period these guidelines will be in effect. However, there is no guarantee that the final strategy would ease harvest restrictions. Uncertainty about the final strategy could potentially increase stress and related social problems. Therefore, it is uncertain how much, or in what direction negative social effects would be influenced by the fact that this interim direction would be in place for only approximately two years.

Finally, the previous discussion focuses on the most negative and debilitating effects of decreases of income, jobs and community stability. As stated, many individuals can, and do cope well with stress and job loss. Many families do survive intact, and many wage earners do find other employment. However, the negative effects discussed occur and though their severity is unknown, these effects exist. The social effects of the alternatives stem fairly directly from changes in the timber harvest levels of the alternatives. This is not meant to indicate that timber harvest is the only meaningful link between the National Forests and people, but it is the most crucial variable among these alternatives.

Effects on County Government and Related Social Effects

Several Sierran counties include a large percentage of National Forest System lands. The Federal Treasury returns 25 percent of gross timber sale (and other) receipts to counties to support roads and schools. These funds are a sizable component of the operating budgets for affected counties.

Reductions in payment (associated with Alternatives 2 and 3-refer to Figure 6) will occur at a time when county governments--a principal source of social services in rural areas and small towns--are pressed to provide help for a citizenry stressed by downturns in employment.

Decreased ability to provide services is discussed in a report to the Association of O & C Counties (Lee et al. 1991: 13-16). They observe: "Any reduction in social services is likely to have adverse impacts on individuals, families and local communities. This diminished capacity to provide social services is occurring at a time when new demands upon social services will very likely result from sharp increases in the number of people unemployed and dislocated by a decline in the wood products economy. Moreover, these same local social services have been seen as vital for helping communities make a transition from heavy reliance on timber to a more diversified base(Whitelaw and Niemi, 1990), (Lee et al. 1991: 13).

Summary effects of Alternatives 2 and 3: To the degree that these alternatives decrease the harvest level on the Sierran National Forests, there could be negative social effects that are not likely to be mitigated. In Alpine, Plumas, Lassen and Sierra Counties, effects will be felt more acutely. There will be job loss and reductions of funds to counties, which will have negative effects on schools and roads and negative secondary effects on other county services as funds are reallocated to schools and transportation.

Effects to Demand and Imports

Statewide Demand for Timber Products and the Relationship to Harvest Levels

With a population that has reached 30 million people and a high level of income per capita, California is one of the largest markets for lumber, wood, and paper products in the world. When discussing the relationship between the demand for timber products (lumber, wood, and paper) and the demand for timber harvest (stumpage), it is necessary to translate the demand for timber products into its timber harvest equivalent. Expressed in these terms, the demand for timber has been increasing, at a rate about equal to the population growth rate. Per capita consumption of lumber has declined while per capita consumption of paper and reconstituted wood products has increased over the past 40 years. As population in the State grew from 10.6 million in 1950 to 30 million at present, total demand increased from 4 billion board feet annually in 1950 to about 12 billion board feet annually at present.

While the demand for timber has been increasing, timber harvests in the State have been decreasing. The difference between the growing demand and the declining supply has been made up by increased imports to the State - primarily from Oregon, Washington, and Canada. The State has changed from a net exporter to a net importer of timber products over the last three decades.

California now relies on imports for more than 60 percent of its overall timber product needs.

Broad Level Socioeconomic Effects

About 95 percent of California's population lives in urban areas. As consumers, the primary effect of changes in harvest levels in California is a change in prices paid for timber products. A reduction in timber harvests in the State reduces competition among suppliers, raises market prices, and leads to increased use of imported products. Econometric analysis done by the Pacific Northwest Forest and Range Experiment Station in 1990 indicates that it takes a one billion board foot change in harvest level (approximately 3 times the effects predicted from the proposed action over the two year period) to change lumber prices by about four percent. This translates into a $250 change in the price of the typical new house at current conversion efficiencies. For the U.S. economy as a whole, this would amount to a cost to home buyers of about $400 million annually.

The high level of competition in the market for timber products means that individual National Forests or individual private timber owners can not significantly affect consumer prices. Although, National Forests or private timber owners in aggregate can significantly affect consumer prices, the short time frame for these interim guidelines, coupled with the current recession and accompanying drop in housing starts, will reduce the effects of either action alternative.

Outlook for Timber Supplies - Imports

The overall outlook is that imports will continue to grow to support increased demands by California consumers over the next 10-15 years. However, imports will likely increase at a lower rate than over the last 20 years and may decrease in availability beyond the year 2000, as the timber supply in Canada and other regions of the United States will be unable to sustain increased harvest rates

indefinitely. This may have limited association with a two-year change in timber harvest levels, however, there will be some relationship to import levels in the short-term.

With the reductions of harvest levels in the Pacific Northwest, national imports should increase (this country is currently a net importer 1/). As the United States has some of the most restrictive environmental laws in the world, increasing imports could potentially have associated negative environmental effects in other countries. However, cause and effect relationships between decrease of harvest levels in this country, and associated increases of negative environmental effects in other countries cannot be made with any certainty. Compensating amounts of timber harvests in other countries can be made in an environmentally-sensitive manner, so conclusions of global negative environmental effects cannot be made.

1/ Production, Prices, Employment and Trade in Northwest Forest Industries, Third Quarter 1991 - USDA Pacific Northwest Research Station.

FUELS

Issue: **How will the risk be reduced of fires which would make California spotted owl habitat unsuitable?**

**** Key Indicators:** **(1) Effects on long-term fuel loading; (2) Effects on fire fighter safety; and (3) Effects on fire occurrence and fuel profile**

Affected Environment

The following discussion of the current fire and fuels situation is partially exerpted from the CASPO Report, Chapter 12.

Fire has always influenced Sierran forests. The mixed conifer forests, which contain about 62 percent of all owl sites, burned frequently before European settlement. Both lightning and Native Americans provided ignition sources. Estimates of fire frequencies range from 5 to 30 years, based on a number of studies of dendrochronology.

Frequent fire maintained surface fuels at reduced levels and kept the understory relatively free of trees and other vegetation which could form fuel ladders. The intensity of fires depended on the length of time that fuels accumulated and the conditions under which they burned. Naturally occurring fires burned under the full range of weather and site conditions. Fires burned for months with periods of increased intensity during hot, dry or windy conditions. The variability in environmental conditions resulted in a variety of effects. The overall result was a mosaic of low-intensity surface fire with patches of overstory mortality caused by areas of higher intensity. The size of these openings averaged less than one acre. Stands regenerated in the small openings created by these more severe fires. These regenerated stands were shade-intolerant and fire resistant. The periodic fires kept the numbers of shade-tolerant and fire-sensitive species relatively low.

Fire suppression policies which began early this century have changed the forest structure and the fuel loading. Areas with short natural fire regimes (fires burned at fairly frequent intervals) such as the mixed conifer zone of the Sierra, changed more than zones that had longer natural regimes, such as the red fir zone. Shade-tolerant, fire-sensitive species (especially white fir) increased dramatically in abundance, particularly in small to medium size classes. Selective harvest has increased this tendency by removing the larger, fire tolerant trees. Fuels on the forest floor have accumulated far beyond their natural levels and hazardous fuel ladders (comprised mostly of white fir) are also present. This situation has substantially increased the probability of large-scale fires resulting in uniform mortality of the overstory trees. The fire regime has changed from frequent, low intensity surface fire to infrequent, high intensity stand replacement fire.

Complicating fire control efforts is the changing demographics of California. The state has a population of nearly 30 million people. Formerly small rural communities are experiencing a large influx of urban dwellers seeking an improved quality of life. An urban-wildland interface has developed with hundreds of primary or vacation residences scattered through a forest matrix. Effectively safeguarding these homes is a priority for the Forest Service. In his letter of July 3, 1992, the Regional Forester communicated his concern to Forest Service employees throughout California, stating that we are now in a situation where "extreme fire behavior and high resistance to control will be the norm, rather than the exception."

The California climate is characterized by a cyclic pattern of wet and dry periods. For the last six years, California has been experiencing a drought cycle similar to many in the past. Stress induced by the drought has caused widespread mortality and decline among forest trees throughout the Region. The quantity of dead and dying trees is causing significant concern on eleven of California's eighteen National Forests. During the drought, the Forest Service has broken all records in mobilization of resources and expenditures of Forest Fire Fighting Funds (FFFF) to manage large and complex incidents. The Region is now engaged in an

intensive effort to harvest the useable volume and to reduce the increased fire hazard represented by thousands of dead trees, many of which are in close proximity to human habitation.

Stands which are unnaturally dense have increased moisture stress, which can lead to tree mortality, particularly during a drought. There has been widespread tree death in the Sierra for the last two years and the basic cause of this mortality is the drought, although stand density has contributed in some areas. The relationship of insect infestation to tree mortality is discussed in the Timber portion of this section. This widespread tree death does not contribute directly to increased rates of spread in the event of a wildfire, however fire spotting and suppression difficulty have increased. Also, these trees killed by the drought eventually fall to the forest floor and contribute to fuel loadings.

Funding

Under current funding scenarios, removal of salvage through timber contracts is the only economical method to reduce fuel load. Much of the dead material, particularly white fir and other smaller diameter trees, will have no economic value one year after they die. Few monies exist outside the timber program that can be applied to salvage. Funding allocated for natural fuels reduction (approximately 1 million dollars for the entire region) may be available. Starting in 1993, funds designated for suppression and prevention of forest pests may be available. However, historically Region 5 has received only a small portion of these funds, because of the need to use them in other Regions for gypsy moth or spruce budworm outbreaks. In any case, neither of these sources is sufficient to pay for a large magnitude salvage program.

Implications of the current wave of mortality to fire control extend well into the future. Stressed trees will continue to die, dead trees will fall and add to the fuel load on the ground, and the threat to homes and forest resources will increase.

Environmental Effects

The CASPO Report concludes than an interim strategy must accomplish three objectives: 1) protect known owl nest sites from any significant degradation 2) Protect large old trees throughout the Sierran conifer forest and 3) begin to cope with the excessive fuels problem.

****Key indicator:** **(1) Effects on long-term fuel loading**

Throughout the range of the California spotted owl, vegetation produces dead material (fuels) faster than the processes of decay can consume it. When the ecosystem interacted with natural fire, these fuel accumulations were periodically consumed by fire. In managed forests, natural fuel accumulations may be augmented by additional dead material added when timber is harvested and debris is left in the forest.

Long-term fuel loadings have been analyzed for the three alternatives based on requirements to retain minimum amounts of dead and down woody material (logs) and the future contribution to fuel accumulations by snags retained on the site.

The CASPO Report covers a large area with considerable variation in rainfall, soils, elevation, aspect and temperature regimes. All of these factors affect fuel succession, the balance between the rate that fuels accumulate and the rate which they decay. A single standard for retention of dead fuels (both those on the ground and standing) does not reflect the variation in fuel dynamics between locations within the area. A single standard defines levels well above natural accumulations on dry sites with frequent fire regimes and well below natural accumulations on wet, cool sites with less frequent fire regimes.

Alternative 1 - No Action

There is no region-wide standard specifying upper limits for dead and downed fuel loadings. Forest Plans contain standards for minimum snag and dead and downed woody fuel retention. They are addressed in terms of minimum retention requirements as they relate to resources, for example, soil productivity, habitat requirements and cumulative watershed effects. No Forest Plan derives a quantitative relationship between fuel amount and condition and fire hazard. Instead, fuel loadings and fire hazard are analyzed on a project by project basis as alternatives are developed. As a result, project decisions are cumulative in the context of watersheds and landscapes. Fuel loadings vary widely from area to area, depending on the decisions and the economics of projects which have affected each acre.

Figure 8 - Minimum Fuel Loadings for Alternative 1.

Average values for coniferous logs and snags found in the analysis area were used for these comparisons. For the purpose of the table, the general standards that are common to most Forest Plans in the Region were used to compute minimum retention levels.

0-3" fuels (tons/acre)	Minimum dead logs (tons/acre)	Potential additions From Snags (tons/acre)	Total (tons/acre)
3-5 *	1.5 (3 20" diameter logs 20' long)	6 (1.5 snags, 30" diameter)	10.5-12.5

* There is no minimum standard for small diameter fuels but it is unrealistic that they would be reduced below this level on any site. (The assumption is that these minimum levels are achieved through management - many acres where no salvage, or thinning, is occurring).

The flexibility of this approach allows the development of levels of fuel retention that respond to the differences between fuel accumulation and decay rates on individual sites. However, the actual amount of fuel retained is usually greater than what is specified by the minimum levels. Collections for fuels treatments can only be made to treat fuels created by the harvest activities; not to treat fuels that accumulated naturally or which resulted from prior activities.

Alternative 2 - CASPO and Alternative 3 - Modified CEA Process

The CASPO Report identifies wildfire as a threat to California owl habitat. One of the primary objectives of the strategy is to reverse excessive fuel buildup and reduce threats to owl habitat from wildfire. This objective is difficult to achieve given requirements to retain snags and dead and down woody material contained in the final version of Chapter 1 of the Report.

The fuel retention levels recommended in the CASPO Report are derived from loadings observed in areas currently occupied by the California spotted owl. Wildfires have been actively suppressed in California since early in the century. Most owls are occupying sites that have not burned in at least 60 years. In many cases nest trees are located in areas with no recorded fire history. The fuel loadings in these areas reflect accumulations of at least 60 years. The range of habitats in which owls can maintain self-sustaining populations is not completely understood. There are no studies of the range of dead woody material (both down and aerial) that the species can tolerate. The birds currently do not have a choice of fuel loadings in forested areas which meet other habitat requirements for tree size and canopy closure.

Figure 9 - Minimum Fuel Loadings for Alternatives 2 and 3.

Average values for dry weights of coniferous logs and snags found in the study area were used for these comparisons. For the purpose of comparison three levels were compared, assuming that 4 to 8 snags of the specified diameter were located in the plot. For the 20 inch diameter example, fewer than 8 snags were needed to meet the 20 square foot basal requirement. It should be noted that these total weights are worst case examples because neither 8 snags per acre nor 20 square feet of basal area in snags greater than or equal to 15 inches in diameter will be retained on acres where they are not present.

	0-11" fuels (tons/acre) *	Minimum dead logs (tons/acre)	Potential addition From snags (tons/acre)	Total (tons/acre)
20" snags	3-5	10-15	5-11	18-31
30" snags	3-5	10-15	16-32	38-52
40" snags	3-5	10-15	32-65	46-85

* There is no minimum standard for small diameter fuels but it is unrealistic that they would be reduced below this level on any site. In most cases they would exceed this amount.

These alternatives will succeed in capturing much of the mortality now present in the Sierran forests as dead and down material on the forest floor. Up to eight snags per acre will be retained on any project area when available, averaged over the entire unit. Fewer than eight snags will be retained in cases where part of the snag requirement must be met by snags less than 30 inches in diameter. This will create a peak in addition to fuel loading because large numbers of dead trees (8 or more per acre) are present in many forested areas.

The success of the overall strategy is highly dependent on reducing surface fire intensity by eliminating most of the fuels less than 11 inches in diameter. Retention of the prescribed amounts of large dead and downed woody fuel and snags will affect the ability to conduct necessary prescribed underburning programs. All snags and logs within burn perimeters cannot be protected. Protection of large dead woody material from consumption will be easiest if the fuel is concentrated in a few very large pieces. It will become increasingly difficult if the loading is distributed as many smaller pieces. Considerable flexibility will be needed in application of requirements to retain logs and snags if underburning is to be applied as a treatment to reduce the risk to owl habitat from wildfire. In addition, current federal and state requirements to protect air quality may limit application of underburning or other types of prescribed burning on a large scale.

****Key Indicator: (2) Effects on fire fighter safety**

Snags are the number two cause of fatalities and serious injury to fire fighters in Region 5. Snags present particular hazards to fire fighters because they ignite easily, burn through and fall unpredictably.

For the purposes of this analysis, a risk zone is defined as a circle around each snag with a radius equal to the height of the snag (refer to project files for graphic analysis of this subject). Three to four snags with a diameter of 20 inches or greater are the maximum limit per acre, before the risk zones overlap to cover the entire acre, leaving no safe area for fire fighters to work. When the number of snags exceed this level, fire

fighting efforts must be relocated to areas with fewer snags, such as ridgetops or other vegetation types. If firelines cannot be relocated, then progress is stopped or slowed while all dangerous snags are felled. More acreage may be burned and more homes lost because firelines or fuel breaks have to be constructed well outside the burning stand to assure that workers are not placed in danger.

Alternative 1 - No Action

Alternative 1 requires a minimum of 1.5 snags per acre be retained in areas harvested. Fire fighters can work in areas with this level of snags if they exercise caution and avoid the risk areas around the snags.

Alternative 2 - CASPO and Alternative 3 - Modified CEA Process

Fire fighters cannot avoid the risk zones around snags if the recommended numbers of snags are retained in harvested areas. Areas which meet the snag retention requirements outlined in the CASPO Report will pose an unacceptable risk to fire fighters until the snags fall to the ground and are added to the dead and downed fuel load. Risk can be mitigated somewhat by clumping of snags over entire cut units. The maximum number of snags is not expected to be met on all acres managed for timber harvest under these guidelines because not all areas currently have this number of snags present.

****Key Indicator: (3) Effects on fire regimes**

None of the three alternatives would affect overall size, distribution or number of wildfires during the interim period. Activities associated with the three alternatives would not impact enough acres to change the fire regime and raise or lower fire occurrence. The various alternatives will result in green harvest and associated fuels treatment on 22,410 acres per year for Alternative 1, 24,940 acres per year for Alternative 2 and 18,630 acres per year for Alternative 3.

Evaluation of the alternatives is based on expected changes in fire behavior on the total number of acres that are expected to be treated, and on expected differences in overstory mortality during wildfires that burn through treated areas.

The wildland fire suppression program in California (all agencies) reached maximum efficiency in 1970 when acres burned per 1,000 acres protected in the State dropped to its lowest level, after a steady decline since 1930. Since 1970 the number of acres burned per thousand acres protected has risen steadily and is currently approaching double the 1970 level. The trend towards increased numbers of acres burned is compounded by the characteristics of wildfires. Most of the acres burned, particularly in forested areas, are burned by large and intense wildfires. Such fires make habitat unsuitable for the owl for at least 60 to 70 years. Fires that would burn under low to moderate burning conditions are easily and efficiently suppressed. Fires escape initial attack and get large under the worst conditions, which contributes to the overall severity of the effects. The three alternatives are evaluated in terms of the ability of treated areas to withstand wildfires burning under severe conditions.

The alternatives are evaluated in terms of

1. Relative resistance of trees to fire.

2. Tendency for crown fire involvement, as it relates to lower crown height, crown bulk density, surface fire intensity and presence of fuel ladders.

3. Tendency to increase or decrease difficulty of fire suppression.

Alternative 1 - No Action

Under the current Forest Plans, Sierran mixed conifer stands will continue to become more homogeneous and the average age of trees will decrease. The overall stand will become more susceptible to fire at lower intensities. For the first five years after harvest, the expected fire behavior relates directly to the amount of dead and down material retained. Plantations become increasingly flammable after they reach 10 to 15 years of age for several reasons. First, young trees of any species in the Sierra Nevada are more susceptible to direct mortality from fire than older trees. Second, young trees have low crowns which are easily ignited by relatively low surface fire intensities. Third, dense, even-aged stands are susceptible to crown fire because of high crown density. These conditions can be mitigated by a combination of surface fuel treatment, thinning and pruning, but funds have generally not been available to do the necessary treatments.

Salvage, thinning and sanitation harvests (refer to the discussion of silvicultural methods in the Other Issues portion of this section) can reduce fire hazard if adequate fuels treatment is accomplished. Fire hazard increases in the short term if the limbs and tops are scattered in the woods. Fire hazard decreases in the long term because of the removal of boles, which would fall and add to the long-term fuel accumulation on the site. These practices can potentially reduce the amount of tree mortality in event of wildfire, but only if the small diameter fuels are removed or treated adequately.

In general, creation of large plantations increases fire suppression difficulty because of the tendency for widespread crowning. Removal of mortality reduces suppression difficulty to the degree that it reduces long-term fuel loading and eliminates spotting and control problems associated with snags.

.ultiproduct and biomass timber sales (refer to the discussion of these types of timber sales in the Timber portion of this section) have positive effects in reducing fuel ladders. The affected National Forests, except the Lassen, all have projected no change in multiproduct timber sales with implementation of the three alternatives. The Lassen projects the highest volume in multiproduct sales (and consequently the most acres) would be harvested under this alternative. However, as discussed in the Biomass section, implementation of Alternative 1 would result in no additional biomass sales, because sawmill residue would continue to provide fuel to the wood energy market.

What this means in terms of reducing the amount of stand-destroying fires is that although the Lassen projects that Alternative 1 would result in more acres of multiproduct sales, this does not compensate for the lack of change in the programs of other Forests, and the lack of increase in harvest of small trees due to a lack of increased markets. Less harvest of small material should occur for Alternative 1 than for the other alternatives. This results in more acres with a higher tendency for crown fire involvement, because of the presence of fuel ladders.

Alternative 2 - CASPO and Alternative 3 - Modified CEA Process

The relative resistance of trees to fire increases with diameter and as lower crown height increases. Big trees with high crowns are the most likely to survive wildfire. The chance of tree survival increases if fuel ladders and lower canopy layers which transport fire from the surface into the crowns are removed. The application of the proposed strategy will tend to raise the average age of trees in stands and reduce fuel ladders, outside of PAC's and Owl Use Areas. The chances of trees surviving wildfire are increased where the treatments recommended by the CASPO Report are applied. The recovery time for owl habitat is much shorter if overstory trees survive wildfire than if most of the overstory is killed.

The probability of crown fire in a stand increases as the density of the crowns increases. Species in the Sierran mixed conifer type differ considerably in crown bulk density. Stands with a higher percent of white fir are more susceptible to crown fire at lower wind speeds. Stands with more ponderosa pine require greater wind speeds to initiate crown involvement. The alternative is silent on recommendations to alter the percent of various species in stands, but in many cases retention of larger trees will favor pine over fir in the mix of species.

The retention of large numbers of snags and large logs will decrease suppression efficiency. Snags are important sources and receptors of embers which cause spot fires discrete from the main fire. Under severe conditions, spot fires can occur several miles away from their source. The work required to fell and suppress fire in snags that could fall across the fire line will decrease the efficiency of fire fighting crews by up to one-half in areas with densities of eight snags per acre. Fire fighters cannot work at night in areas with high numbers of snags. When areas of high snag densities must be avoided because of safety concerns, the fire area will become bigger, the amount of total fire line increases and the costs of fire suppression go up.

These alternatives will result in an increased trend to harvest small trees in biomass timber sales (refer to the discussion of these types of timber sales in the Timber portion of this section) because of increased demand in the energy wood market resulting from decrease sawmill contribution. This trend compensates for the lower volume, and related lower acreage predicted for multiproduct timber sales on the Lassen National Forest.

As also discussed in the Timber portion of this section, Alternative 3 has fewer "available" acres than does Alternative 2. This means that even though the demand for the wood should increase, Alternative 3 allows less opportunities for this harvest to occur. Thus, less acres should be harvested in biomass timber sales for Alternative 3.

What this means in terms of reducing the amount of stand-destroying fires is that Alternative 2 should result in the most acres of harvest of small material which results in the fewest acres with a high tendency for crown fire involvement, because of the lack of fuel ladders. Alternative 3 should result in acreage of biomass timber sales mid-way between the two other alternatives.

INDIRECTLY RELATED RESOURCES

Forest Cover and Silvicultural Systems:

Issue: **How will the alternatives affect continuous forest cover?**

****Key Indicator:** **Acres of regeneration harvests**

There currently is not a precise definition of continuous forest cover. This feature of the forest environment is primarily based on visual perception of the overall landscape. There is debate about whether any regeneration harvest, including group selection, provides continuous forest cover, and heavier thinnings may not meet some individual's perception of continuous forest cover.

However, for the purposes of this analysis, the regeneration harvest methods of clearcutting and shelterwood seed cuts will not be considered to provide continuous forest cover. Group selection will be considered to provide continuous forest cover. This interpretation is made because group selection tends to mimic natural regeneration patterns and other harvests (intermediate harvests), while variable in appearance, tend to leave sufficient forest vegetation that a perception of continuous forest cover is maintained. Because of the limited and short term amount of cover that trees without needles provide, salvage is not considered to affect continuous forest cover either positively or negatively.

A reduction in even-aged, regeneration harvests (clearcutting and shelterwood methods) would increase continuous forest cover proportionally. Partial harvests, including thinning, single trees selection, and the "thinning from below" method proposed in the CASPO alternative, and the same method on fewer acres in the Modified CEA Alternative, will produce few openings. What openings are created will mimic group selection and these openings will be usually less than 2 acres in size, and typically would be less than one acre in size. As stated, these openings will still meet the definition of continuous forest cover.

Alternative 1 (No Action) projects that approximately 8,970 acres of regeneration harvests (clearcutting and shelterwood seed cuts) would be scheduled yearly. Alternative 2 (CASPO) projects that approximately 6,040 acres of regeneration harvests would be scheduled in FY 93 and approximately 4,100 acres in FY 94 with a yearly average of approximately 5,070 acres of regeneration harvests. As discussed previously, this is due to completing previously planned timber sales on the Eldorado and Lassen National Forests. Other National Forests have some regeneration harvest scheduled for FY 93 and none for FY 94. These acres of regeneration harvests in both Alternatives 2 and 3 result from "carryover" from the CEA process, and from harvests outside of suitable owl habitat. Alternative 3 (Modified CEA) projects a yearly average of approximately 4,630 acres of regeneration harvests. Proportions of these harvests by year are approximately the same as for Alternative 2.

Therefore, Alternative 3 would best meet continuous cover objectives, and Alternative 2 is relatively close to Alternative 3 in also meeting this objective. Alternative 1 has the most acres of regeneration harvests projected, and thus ranks third in response to this issue.

Note that these numbers differ from the figures presented in the Wildlife discussion. Although overstory removal is an even-aged harvest method, it meets the definition of continuous forest cover. Therefore, these numbers will be different from discussions of even-aged harvest effects elsewhere.

Issue: **How will the alternatives affect acres of forest silvicultural systems and methods and how will these systems and methods affect key owl habitat components?**

****Key Indicator:** **Acres of silvicultural systems and methods (per year).**

Before discussing effects on forest silvicultural systems by the alternatives, a discussion of the systems themselves is helpful. Also discussed are the harvest methods associated with the silvicultural systems, and some of the broad advantages and disadvantages of each. A silvicultural system is a process whereby forests are tended, harvested, and replaced resulting in a forest of distinctive form. There are basically two different silvicultural systems, even-age and uneven-age, each of which includes a number of different cutting methods.

Timber stands themselves are defined as the fundamental areas, usually of homogeneous vegetation, which make up the landscape.

Even v. Uneven-aged Management

Silvicultural systems are grouped into two general types; even-aged and uneven-aged systems. Under even-aged management, the majority of trees in a stand are approximately the same age. An uneven-aged stand contains at least three age classes. All gradations of age distribution can be found in natural and managed stands. Figure 10 presents a comparison of even-aged and uneven-aged systems by listing some typical advantages and disadvantages of each. The list represents general considerations that influence decisions to utilize one system or the other on portions of the landscape.

Although the pattern and extent of tree removal is actually based on site-specific information for each stand, prescriptions can be grouped into general categories. Following the general comparison of even versus uneven-aged systems is a discussion of silvicultural prescriptions. Some of the titles for the modifications of traditional clearcutting prescriptions differ from standard titles to place a greater emphasis on the portions of the stand that remain and develop after cutting is complete. Figure 11 presents a comparison of the silvicultural prescriptions by listing features that are important to owl habitat.

Figure 10 - Comparison of Silvicultural Systems

EVEN-AGED		UNEVEN-AGED	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Favors shade intolerant species: ponderosa pine, Douglas-fir, sugar pine	Size of opening can increase potential for erosion and site deterioration	Good site protection and reduced erosion potential	Increased risk of damage to future crop trees
Fewer large tree entries over smaller area, for lower transportation densities used less frequently	Contrasts created by large openings reduce visual quality	Smaller openings for higher visual quality	Frequent entries over larger area, potential for higher transportation densities
More cost efficient/Lower cost for: Preparation-Marking Harvest Fuel Treatment Tracking and Controlling (stand development and treatment needs) Control of Competing Vegetation	Interior habitat reduced for long period of time	Interior habitat maintained after cutting	Less cost efficient/High cost for: Preparation-Marking Harvest Fuel Treatment Tracking and Controlling (stand development and treatment needs) Control of Competing Vegetation
Control over regeneration, species composition, and introduction of improved stock		Maintenance of high forest cover over time	Difficult fuel treatment can increase fire hazard
Forage for large game			Difficult to implement on ground over 35% slope

Figure 11 - Silviculture and Owl Habitat

SILVICULTURAL PRESCRIPTION AND HABITAT ELEMENTS IMPORTANT TO THE OWL→	CC	LCR	MCR	SW	OSR	GS[4/]	STS	CT[5/]	SAN[6/]	CAS
NUMBER OF LEAVE TREES [1/]										
Live Conifers [1/]	0	1-2	2-10	10-20	0	1-3	20-30	50-75	10-30	10-20
CANOPY CLOSURE (%) [2/]	0	3	3-15	15-30	0	50-60+	60+	40-60+	40-60+	25-40
CANOPY LAYERS [3/]	0	1-2	1-2	1	0	2-3+	2-3+	1-2	1-3	1-3

CC = Clearcut, LCR = Clearcutting with light conifer retention, MCR = Clearcutting with moderate conifer retention, SW = Shelterwood, ST = Seed tree, OSR = Overstory removal, SAN = Sanitation, STS = Single Tree Selection, CT= Commercial Thin, GS = Group Selection, CAS = CASPO guidelines

Note in particular that crown closure and canopy layers increase over time after regeneration harvests are made. This is discussed and illustrated later in this analysis.

[1/] - Minimum diameter 24 inches where available in stand

[2/] - Canopy closure contributed by trees $\geq$ 20 feet tall. Many prescriptions have canopy contributed by trees < 20 feet tall, but this doesn't contributed to canopy closure for spotted owl habitat.

[3/] - Canopy layers are just those contributed by trees $\geq$ 20 feet tall. Many prescriptions, especially OSR, may often have significant canopy contributed by trees < 20 feet tall.

[4/] - Number of leave trees refers to the number of trees reserved > 24 inches left within actual groups treated by harvest (usually 0.5-2 acres in size). Canopy closure and layers refer to the stand as a whole including areas within groups (which are like small CC or LCRs).

[5/] - Many CT prescriptions are employed in stands with average diameters of only 12-16 inches to control stocking density and accelerate growth to achieve suitable owl habitat more quickly.

[6/] - Sanitation usually only removes 2-5 trees/acre in sanitation/salvage. Final canopy closure and structure are not significantly changed by harvest treatment.

EVEN-AGED SYSTEMS

A stand is considered to be even-aged when all of the trees within it are close to the same age (generally less than 20 percent variation in age between trees). Several cutting methods are employed within the even-age system including clearcutting, shelterwood, seed tree and intermediate harvest, with variations possible within each of the methods to meet resource objectives.

Even-aged systems typically appear as a mosaic landscape pattern composed of patches (stands) in different stages of growth. The size of individual patches typically range from three to 40 acres. Some even-aged prescriptions include the retention of green trees on the site. The quantity, size, species and distribution of leave trees differ depending on stand objectives. These prescriptions are designed to meet various objectives and are described mainly in terms of the quantity and distribution of leave trees.

Harvest entries for this system often include one to three commercial thinnings and one final harvest. Regeneration of openings by planting is usually scheduled immediately following site preparation. Planting not only insures prompt regeneration within required time frames, but also provides opportunities to mimic natural species mix and use genetically superior seedlings. Under the right conditions, natural regeneration from adjacent seed sources can fill in among planted trees, especially on the more productive sites. A greater proportion of natural regeneration is expected where more trees remain on the site after harvest.

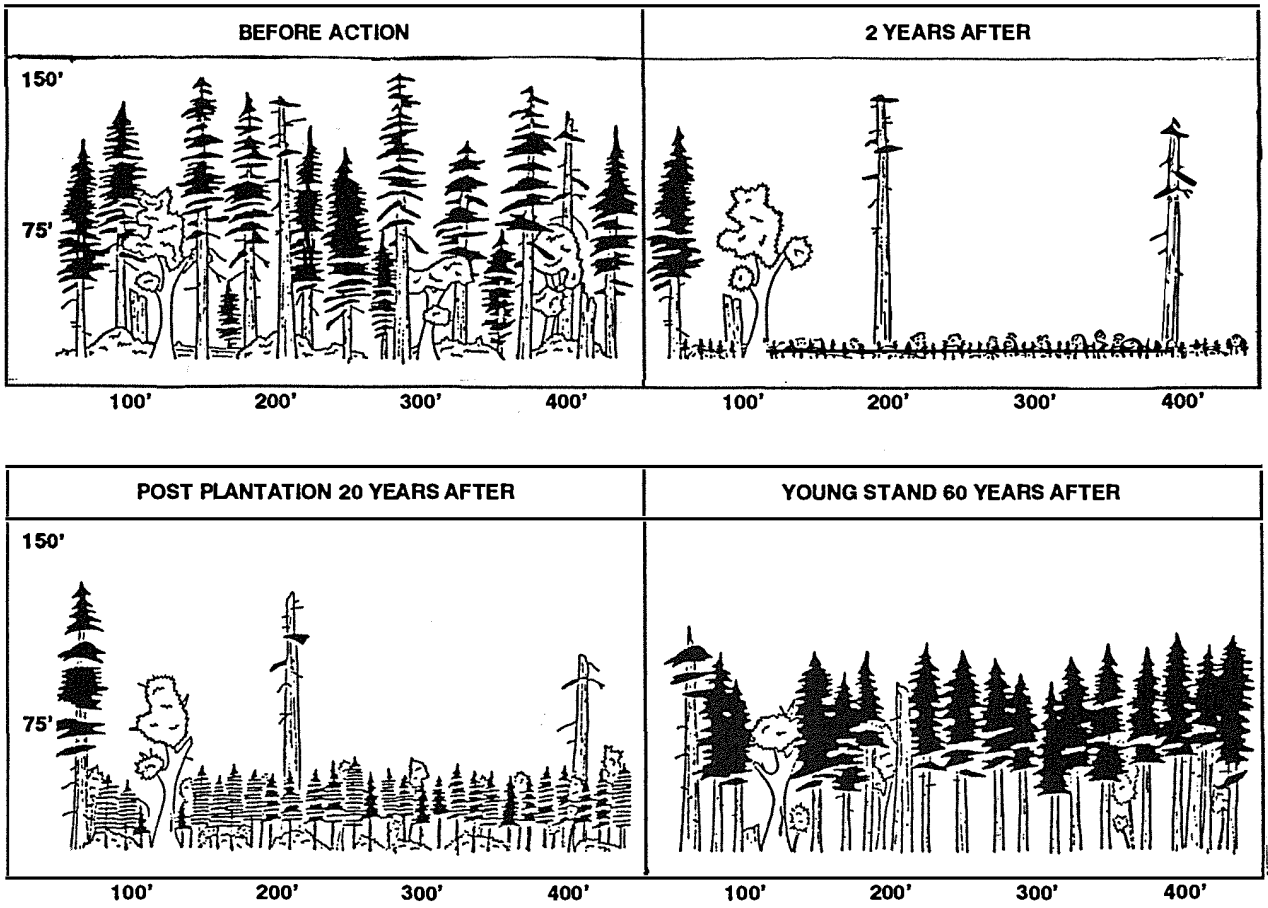
a. Clearcutting

Traditional clearcutting involves the removal of all trees from a stand in one harvest operation, essentially a "bare ground" approach. As stated previously, this prescription is used less frequently today, replaced instead by "clearcutting with reserves." This is done most often on tractor-operable ground as it is much more difficult to retain desired trees or groups of trees on cable ground. Data for fiscal year 1991 indicates approximately 20 percent of clearcuts were clearcuts with reserves.

These clearcuts with reserves bear little resemblance to bare-ground clearcuts, retaining what can be a significant canopy cover in thrifty, healthy trees ranging in size from advanced regeneration of seedlings and saplings up through poles and small sawtimber, as well as snags and large woody debris. Clearcutting with reserves, although more costly and complex to implement, provide a number of benefits including: silvicultural and economic benefits of retaining healthy, vigorous advanced regeneration; retention of structural elements important to wildlife; more maintenance of continuous forest cover in portions of the stands; and softening of the visual appearance of harvesting and reduction of watershed effects due to more vegetative interception of rainfall.

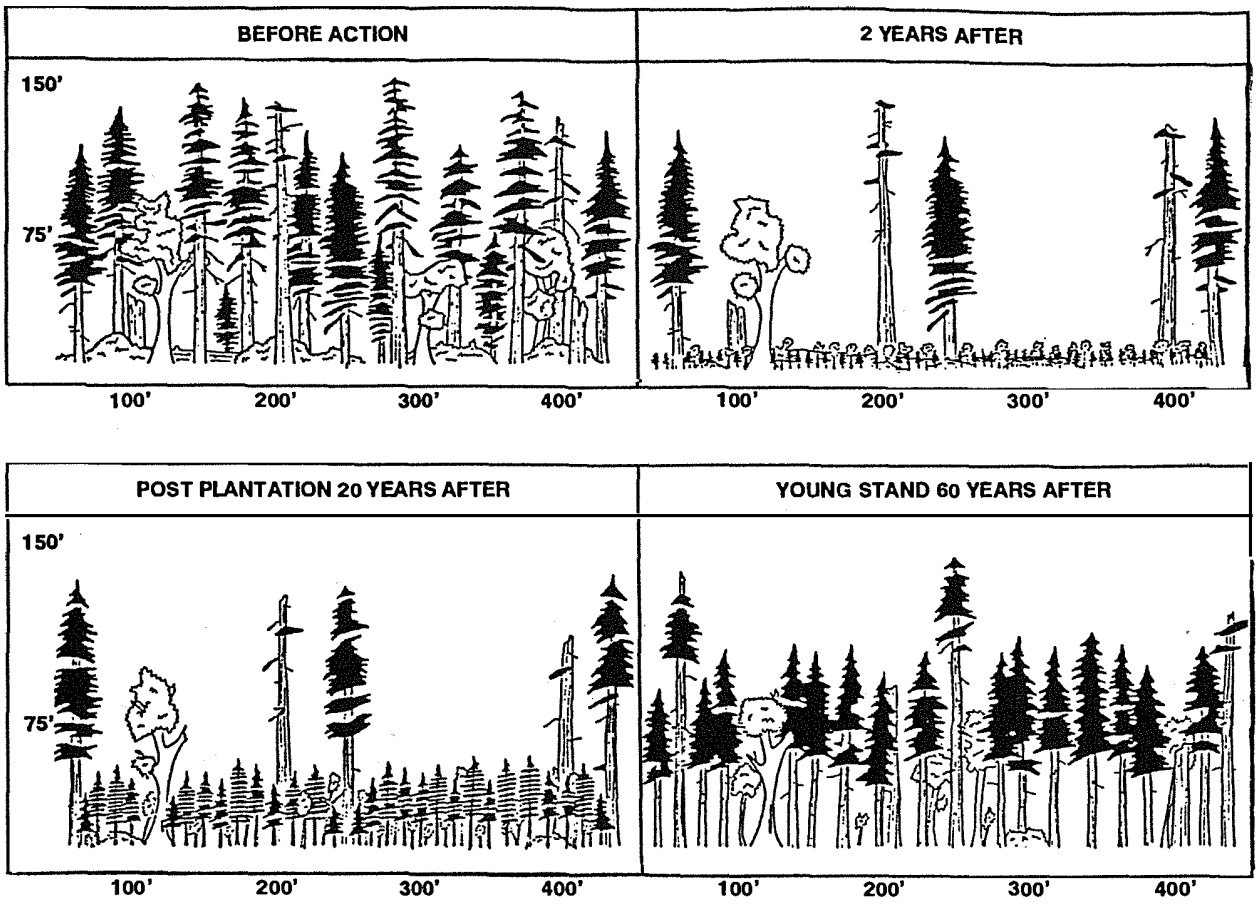
Clearcutting, even in its more traditional form, can be the only feasible method for reestablishing a productive forest stand where insect or disease infestations are severe, or following catastrophic events such as fire. Although the mosaics do help soften visual quality effects, these effects are still greater than for the other methods. Again, although mosaics reduce watershed effects, the lack of canopy in comparison to other harvest methods increases erosion potential over that of the other methods. These effects are discussed in more detail in other portions of this analysis.

CLEARCUTTING WITH LIGHT CONIFER RETENTION (LCR)



This prescription is similar to a traditional clearcut with an increase in reserve trees. Reserve trees are selected to provide for wildlife uses, riparian protection, maintain local genotypes for genetic diversity, and other resource needs. Unmerchantable vegetation, other than reserve trees and clumps, typically will be felled and cleared after logging is complete. This prescription is used when its use meets resource objectives. Conditions which might warrant this prescription include: high windthrow potential, presence of disease, lack of additional suitable leave trees, and restoration of natural species mix.

CLEARCUTTING WITH MODERATE CONIFER RETENTION (MCR)

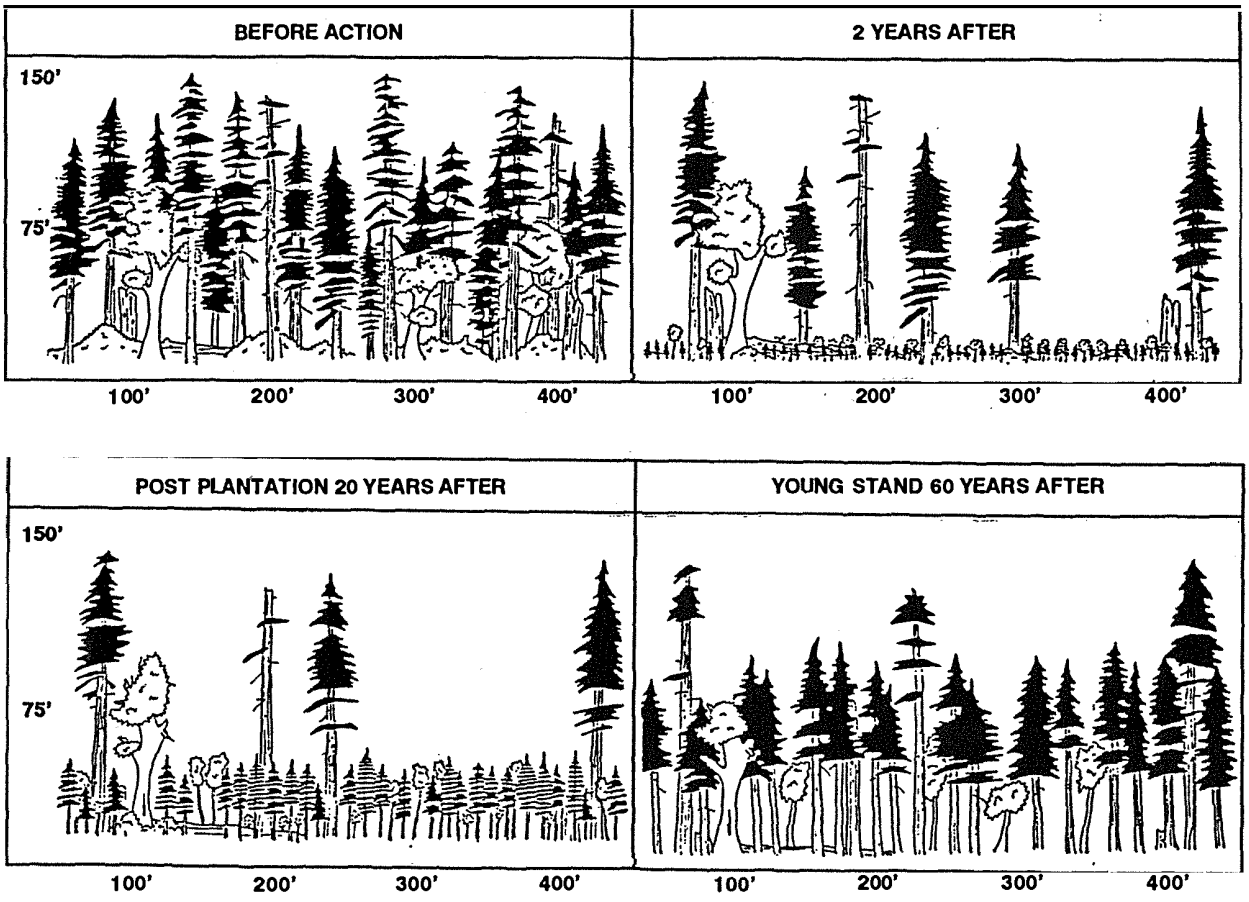


The MCR prescription is similar to LCR except that reserve trees are generally greater in number, and more widely distributed. While reserve trees are primarily intended for wildlife snag recruitment and visual reasons, they may serve concurrent functions such as a source of seed for natural regeneration, and maintenance of structural diversity through the next rotation.

b. Shelterwood (SW)

The shelterwood method is utilized to regenerate a new stand, under the shade and protection of overstory trees, in a series of harvests. The first of these harvests removes most of the existing overstory trees, generally leaving 10-20 trees per acre to serve as the shade and/or seed trees (some shelterwoods are regenerated by planting). The number and species of the overstory trees retained is dependent upon a number of factors including the desired species to be regenerated, amount of shade/protection desired, disease/insect considerations and other management objectives.

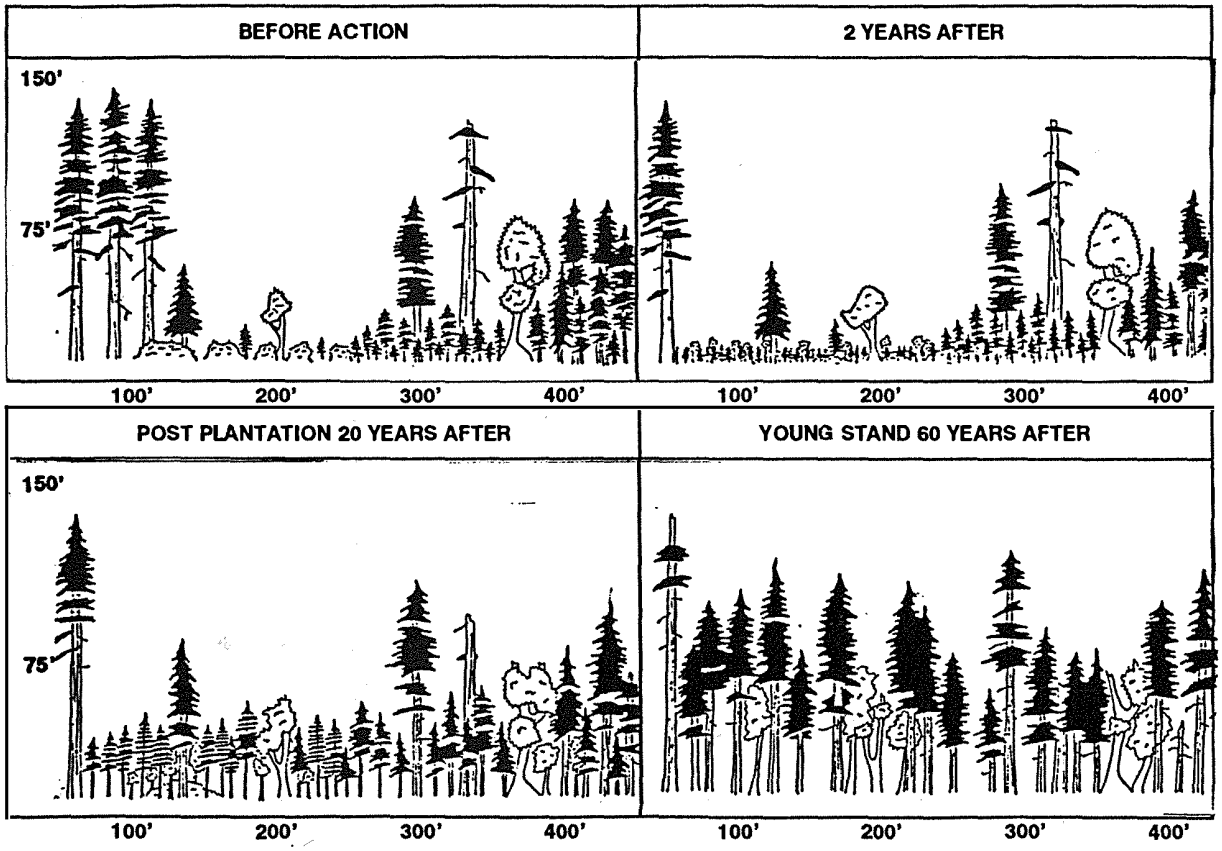
This method may be more economical than clearcutting where it reduces the need for planting.



c. Overstory Removal (OSR)

After the stand has satisfactorily regenerated after either a shelterwood harvest or a seed tree harvest and the trees are about 3 feet tall, the overstory is then removed. The term "overstory removal" is used anytime to refer to the removal of larger, scattered overstory from a well-stocked, releasable understory, whether natural or planted. It is also possible, as a variation on the strict shelterwood, where all of the overstory is removed following regeneration, to retain all or part of the overstory trees to meet other resource objectives including continuous forest cover and wildlife habitat.

Reserve trees are left for structural diversity, seed production for natural regeneration, to supplement planting, site protection, visual texture and/or screening, and eildlife habitat. This method is used primarily to provide a protected environment to enhance seedling survival through the establishment period. Typically most of the large trees left on the site will be removed in approximately eight years.



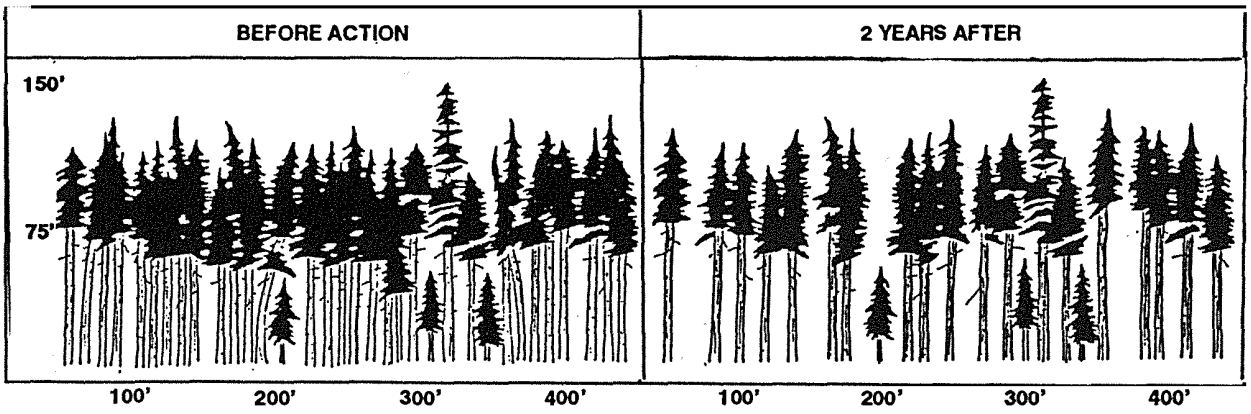
Overstory removal after successful regeneration of a shelter wood or seed cut harvest will result in an even-aged older-seedling or young sapling stand. After over story removal from another stand, the remaining stand will contain a non-uniform distribution of scattered and clumpy pole, sapling, and sawtimber size trees in combination with areas of bare soil. Overstory reserve trees will be left to provide snag habitat for cavity nesting wildlife species, visual screening, and structural diversity. Openings will be regenerated by planting, and overstocked areas will be precommercial thinned. In time the planted trees will merge with the reserve poles and saplings, resulting in a relatively even-sized stand.

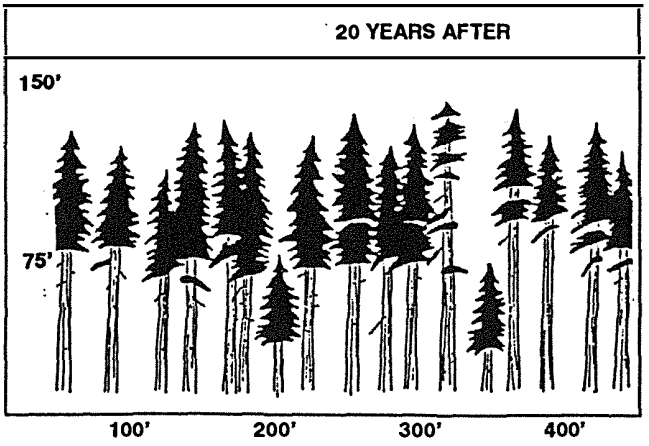
d. Intermediate Harvest

An intermediate treatment is any manipulation in a stand that occurs between regeneration cuttings. These type of treatments are used in developing stands to achieve desired species composition, growth performance or to recover values that might otherwise be lost.

Cutting methods included in this category are commercial thinning, sanitation and salvage. Commercial thinning is designed primarily to control stocking density and maintain or improve stand health and vigor. Sanitation harvest focuses on removing trees at high risk of insect and disease mortality in order to maintain stand health or improve. Salvage harvest, on the other hand, is designed to remove dead/dying trees before their economic value is lost. Salvage does not generally affect stand health either positively or negatively, except in very narrow and unusual circumstances.

COMMERCIAL THINNING (CT)





Commercial thinning is applied to overstocked or potentially overstocked stands. It allows for harvest of imminent mortality and maintains stand growth or vigor by increasing available moisture, nutrients, and light to the remaining trees. Thinning tends to extend the time period during which the trees are growing at an optimum rate for the site.

After thinning the density of the remaining stand is normally determined by stand age, condition, and management objectives. Snag densities are expected to remain relatively unchanged; although, logging damage or fuel treatment activities may increase the densities of snags in the long-term. Fuel treatments will consist of lopping and scattering of logging slash, or underburning depending upon the amount of existing and created fuels.

Commercial thinning is prescribed to meet a variety of objectives, including maintenance of stand health, holding stands at high volumes for future regeneration harvests, and enhancement of wildlife habitat. These objectives can be met by varying residual stand densities. Opening the stand allows more sunlight and moisture to reach the forest floor. This promotes understory growth and ground cover, increasing vegetative diversity. Thinning can also increase horizontal and vertical diversity while maintaining interior habitat conditions and fostering stand vigor. Diameter growth of the residual stand is maintained thereby hastening the development of immature stands to mature and old-growth stages.

e. Sanitation (SAN)

Sanitation cutting is the removal of insect-attacked or diseased trees to help maintain health of the stand. Generally, individual trees with poor health and vigor are removed to maintain the healthy development of the remaining trees. Standards will be met for snag distribution by marking snags and future snags to be retained on the site.

UNEVEN-AGE SILVICULTURAL SYSTEMS

A stand is considered to be uneven-aged when it consists of intermingled trees varying widely in age. All ages and sizes of trees from regeneration to mature trees are theoretically represented in the stand. In natural stands, or stands with limited management, it may take many years and many limited harvests to achieve "ideal" all age and size conditions. Two cutting methods, single tree and group selection, are employed in uneven-age silvicultural systems.

Uneven-aged systems apply a combination of actions within a stand to maintain continuous high forest cover, recurring regeneration of desirable species, and growth and development of trees through a range of age classes. Age classes can be arranged by individual stems or even-age groups. Uneven-age systems are applied to stands where management objectives are better obtained with three or more age classes and/or where resource considerations such as watershed sensitivity and visuals may preclude the use of even-age systems.

Opportunities to best utilize uneven-age management are on flat or gentle sloping ground where tractor harvest is possible. Typically this system requires higher densities of roads and skid trails than necessary for even-age management. Helicopter harvesting may reduce the need for additional roading and skid trails, but will greatly increase costs of harvest, fuels treatment, reforestation, and cultural stand improvement treatments.

a. Single Tree Selection (STS)

In the single tree selection method, individual trees, or a small group (< 0.25 acre in size), are removed and new regeneration occurs in their place. This method favors very shade tolerant species which can become established and survive under such small openings in the canopy. Harvest under the selection method calls for very frequent partial cuts in a stand. The intent is to create, within a single stand, a

self-sustaining forest in which trees of several to many ages and sizes are present, intermingled with each other. At each harvest entry, tree regeneration is obtained, immature trees are thinned and mature trees are harvested. While single tree selection may produce less timber volume than other cutting methods and may not be suitable in stands heavily impacted by insects or diseases, it does have several advantages including maintenance of continuous forest cover, provision of habitat for late seral stage wildlife species and retention of a natural visual appearance.

b. Group Selection (GS)

The group selection method creates larger openings in an uneven-aged stand than the single tree selection method, but the openings are still small enough to appear natural and maintain a fairly continuous forest cover. Openings are generally no more than one to two tree heights in size (0.5 to 2 acres). This method produces a series of small even-age groups of trees which in the aggregate produce an uneven-age stand.

Group selection meets the objectives of uneven-age management while retaining a number of the benefits of clearcuts such as: permits management of insect and disease infestation centers (provided the entire stand is not heavily infected); allows enough room for mechanical harvest operations (felling and yarding) so that damage to the residual stand is reduced; the number of harvest entries on a particular piece of ground are reduced which also limits the amount of tree wounding; provides the opportunity for regeneration of all species, including shade-intolerants; concentrates harvest on fewer acres which allows for management on a scale which is reasonably economic and efficient; and fosters forest health by focusing treatment of high priority portions of the stand while providing growing space to insure healthy, vigorous regeneration.

This system is used to progressively regenerate and manage the larger stand area with a balanced age class distribution. The larger stand becomes a self-contained, sustained yield unit where regular outputs of timber volume are realized over the long term. Reforestation is a combination of artificial and natural regeneration.

Small openings create even-aged clumps of early successional vegetation and enhance vertical and horizontal diversity in the stand as a whole. However, the relatively frequent harvest entries and other stand tending activities may offset the potential benefits of maintaining a high percentage of forest cover for species that are sensitive to periodic disturbance and displacement.

CASPO GUIDELINES (CAS)

CASPO recommendations are not a prescription, but rather minimum guidelines to be used in developing prescriptions. The harvest methods and constraints recommended by CASPO do not really fit into any standard definition of silvicultural systems. It is not designed to be an even-aged system, yet its requirement to retain the largest trees results in fairly even-aged appearance. It is not designed to regenerate stands, yet openings could result which mimic uneven-aged group selection. The most descriptive standard terms for CASPO recommendations could be likened to "thinning from below" although it is not designed to leave stands at any particular spacing. Prescriptions resembling selection harvests or group selection could also occur. Implementation of CASPO recommendations will result in a single storied fairly well-stocked (although gaps or small openings may occur), large overstory, if the guidelines are applied to the minimum standards.

Figure 12 - Acres of Silvicultural Systems and Methods (per year)

Alternative 1 - No Action:

Even-age		Uneven-age			Intermediate
Clearcut[1]	Shelterwood/OR	Group Sel.	Single Tree[2]	CASPO	Thin/San[2]
3,830	6,090	2,110	480	0	9,800

TOTAL ACRES TREATED = 22,310

Alternative 2 - CASPO:

Even-age		Uneven-age			Intermediate
Clearcut[1]	Shelterwood/OR	Group Sel.	Single Tree[2]	CASPO	Thin/San [2]
2,150	3,270	1,320	280	12,220	5,700

TOTAL ACRES TREATED = 24,940

Alternative 3 - Modified CEA Process:

Even-age		Uneven-age			Intermediate
Clearcut[1]	Shelterwood/OR	Group Sel.	Single Tree[2]	CASPO	Thin/San [2]
1,960	2,790	1,250	280	7,300	5,050

TOTAL ACRES TREATED = 18,630

[1]Approximate proportions of clearcutting for FY 93 for all three alternatives are about one-third bare-ground clearcutting, one-third clearcutting with light conifer retention, and one-third clearcutting with moderate conifer retention. In FY 94 there is a predicted shift on the acres clearcut to about 15 percent bare-ground clearcutting for Alternative 1, with the other 85 percent evenly split between light and moderate conifer retention. For Alternatives 2 and 3, very little of the clearcutting planned is predicted to be bare-ground, with the clearcutting split between light and moderate conifer retention.

[2]Single tree selection and intermediate thinnings include acres to be examined for treatment, but not necessarily treated, so acreage may be 10-20% higher than will actually be treated.

Forest Insect and Disease Conditions

There are many diseases and insects that affect the health of individual conifer species in the Sierra Nevada mountain range. Chief among them are: dwarf mistletoes, annosus root disease, black stain root disease, decay fungi, defoliating insects, and bark beetles. All are endemic and pervasive throughout the Sierra. The effect of these damaging agents on timber stands is largely a function of three factors: 1) stand structure, 2) stocking levels, and 3) natural or human-caused wounds on trees within the stand.

As explained in Appendix D, a single-species, multi-storied stand structure is more favorable to dwarf mistletoe spread and defoliating insect buildup than is a multi-species, single-storied structure. Heavy stocking in trees and other vegetation that compete with desirable trees for moisture and nutrients causes physiological stress which reduces resistance to bark beetle attack and the spread of black stain root disease (a disease that is borne by an insect vector). Freshly cut stumps, wounds that remove the outer bark, and broken limbs all provide infection entry points for the annosus root disease and decay fungi. In general, anything that adds stress to a timber stand, including drought and air pollution, exacerbates the effect of damage caused by insects and disease.

Current stand conditions relative to insect and disease susceptibility are highly variable throughout Sierran forests. Past logging has resulted is some relatively open, vigorously growing stands and planted areas. Past logging has also created infection entry areas by creating stumps and physical damage to residual trees. Fire exclusion has allowed some trees to escape fire scarring, but it has also encouraged the reproduction of a single species, white fir, sometimes at very high densities.

Issue: **How will the alternatives affect timber stand insect and disease infestation?**

****Key Indicators:** **Acres of silvicultural practices which can achieve appropriate tree density; numbers of trees with mistletoe and a stand structure amenable to the spread of infection; need for multiple entries with attendant risk for wounding trees**

Alternative 1 - No Action

Implementation of Alternative 1 would result in green harvest activities on an average of approximately 22,310 acres per year within the seven affected national forests of the Sierran province. Of this, 9,920 acres (44 percent) would be managed under even-age silvicultural systems. Approximately 39 percent of the 9,920 even-aged harvest acres would utilize clearcutting (3,830 acres). An additional 12 percent (2,590 acres) would utilize uneven-aged management, 44 percent (9,800 acres) would receive intermediate harvest treatments including commercial thinning and sanitation. No acres will follow CASPO guidelines.

Because of the relatively high proportion of even-aged regeneration cutting and intermediate harvesting, forest health would be improved or maintained on those acres treated, with this alternative. Both of these harvest systems provide for control of stand structure and stocking densities that favor tree vigor, and hence increased resistance to insect and disease damage. On those acres where uneven-aged management is applied, stocking control would be effective at promoting tree vigor. However, the resulting multi-layered stand structure would favor the continuing development of dwarf mistletoes, root diseases, and defoliating insects.

A major portion of even-aged harvest prescriptions, and all of the uneven-aged prescriptions, would call for some amount of reserved stocking after logging. On these acres, damage to residual trees invites fungi infection, and to a lesser extent, insect attack. Damage caused by tree felling and yarding is more probable with uneven-aged prescriptions because there are generally fewer and smaller openings that allow for maneuverabilty. All harvest prescriptions, of course, create stumps. In this case there are standard

procedures for preventing infection by the annosus root disease. Regardless of the management system used, protection of the residual stand is an important administrative feature of the harvest operation.

Alternative 2 - CASPO

Implementation of Alternative 2 would result in harvest activities on approximately 24,940 acres per year within the 7 national forests of the Sierran province. Implementation of CASPO recommendations would not be 100 percent due to carry over from sales with decision notices from the early part of FY 93 and on some National Forests, because of scheduled activities in eastside pine types. Of 24,940 acres, 5,420 acres (22 percent) would be managed under even-age silvicultural systems. Approximately 40 percent of the 5,420 even-aged harvest acres would utilize clearcutting (2,150 acres). Fifty-five percent (13,820 acres) would utilize uneven-aged management and of these 12,215 acres (88 percent) would be under CASPO guidelines. An additional 23 percent (5,700 acres) would receive intermediate harvest treatments including commercial thinning and sanitation.

In classical forest management, the oldest, least vigorous and poorest growing trees would be harvested to make room for regeneration and growth of healthy, more vigorous trees. This would occur to a certain extent with the non-CASPO prescriptions utilized in this alternative.

Under the CASPO guidelines, many of the larger trees would be retained regardless of their health, vigor, or disease. Harvest would be targeted at trees less than 30 inches dbh. In many cases, actual harvest would be restricted to trees less than 26 inches dbh because of constraining basal area requirements. (Refer to the Effects to Products discussion.) While this would result in removal of some trees which are diseased, suppressed and of low vigor, it could also result in removal of trees which are young, thrifty and future replacement nest/roost trees.

More importantly, maintaining 30-40 percent of the stand's basal area in the largest trees could result in growth suppression of newly established seedlings. The established roots of existing trees efficiently capture limited moisture and nutrients effectively preventing new seedlings from obtaining needed resources and developing roots systems. The magnitude of this competitive effect on the existing stand depends upon its "clumpiness." In some stands this clumpiness may result in openings large enough for seedling development with minimal competition.

On those acres treated, regeneration of shade-intolerant pines would be hindered where openings are too small to allow for good growth. For appreciable pine regeneration and growth, most openings would need to be larger than 1/2 acre in size, and preferably up to two acres. The level of dwarf mistletoe infection would be expected to increase as shade tolerant species increase, leading to the probability of a reduced species mix.

Implementation of CASPO guidelines may result in a certain amount of low vigor and decadence and a higher level of insect and disease activity on those acres treated. However, where implementation of CASPO guidelines would cause an unacceptable level of loss of stand health, there is the option of deleting the stand from the timber sale, or exceeding CASPO guidelines, if that would improve the situation.

Alternative 3 - Modified CEA Process

Implementation of Alternative 3 would result in harvest activities on approximately 18,630 acres per year within the 7 national forests of the Sierran province. Implementation of CASPO recommendations would not be 100 percent due to carry over from sales with decision notices from the early part of FY 93. Of 18,630 acres, 4,750 acres (25 percent) would be managed under even-age silvicultural systems. Approximately 41 percent of the 4,750 even-aged harvest acres would utilize clearcutting (1,960 acres). Forty-seven percent (8,820 acres) would utilize uneven-aged management and of these 7,300 acres (82 percent) would

be under CASPO guidelines. An additional 27 percent (5,050 acres) would receive intermediate harvest treatments including commercial thinning and sanitation.

Environmental effects are similar as those for Alternative 2, although to a different magnitude due to the different acreages of treatments.

Other Wildlife Species

Issue: **How will the alternatives affect other wildlife species, particularly species associated with late-successional forest habitats?**

****Key indicators:** **(1) Acreage in various seral stages. (2) Fragmentation of late-successional forest habitat. (3) Habitat structure. (4) Compatibility with management needs for threatened, endangered, and other sensitive species in the Sierran province.**

The alternatives developed for this analysis were designed to consider management for the California spotted owl and were not developed based upon consideration of the needs of other species. The guidelines proposed in these alternatives will not supercede already existing guidelines in individual Forest Plans designed to maintain habitats for other species. The guidelines described here will be combined with other species needs in designing site specific projects. A thorough assessment of potential effects on other species if the proposed alternatives are implemented independent of other design standards and potential mitigating measures would require several assessments comparable to the one completed by the Technical Team for the California spotted owl.

The California Wildlife Habitat Relationships (WHR) database, identifies 263 species within the range of the owl (Appendix B). The relative effects of the alternatives upon these other wildlife species can be evaluated in general terms by grouping these species into those associated with early and mid-successional forests, and those associated with late-successional forests. Site specific effects will be evaluated and additional design standards or potential mitigation measures determined, where appropriate, during project level analysis.

These alternatives are not expected to have an adverse effect on any threatened, endangered, or sensitive species, except the California spotted owl, since they will only be implemented through projects designed to take care of other species needs as well. Effects upon species designated as threatened, endangered, or sensitive, are discussed in further detail in a Biological Evaluation (Appendix C).

Wildlife Associated with Early and Mid-Successional Forests

Affected Environment

A variety of wildlife species within the range of the owl use early-successional habitats for breeding, foraging, or cover (Appendix B). These species include mule deer, pocket gopher, mountain quail, green-tailed towhee and others.

Chapter 12 of the CASPO Report describes historic changes that have occurred in Sierran Forests. From this discussion it is clear that today a greater proportion of the acres burned in the Sierra Nevada are burned in large stand replacing fires, than was the case historically. The amount of acreage burned in stand-replacing fires, in combination with even-aged harvest methods, has created a substantial amount of early-successional forest across the landscape.

Environmental Consequences

There is no reason to envision a shortage in the amount or distribution of early and mid-successional habitat stages under any of the alternatives. The alternatives will, however, provide differing amounts of early-successional habitat.

Alternative 1 - No Action

Continued management of the owl under the guidelines established in Forest Plans, will provide the greatest amount of habitat in early-successional forest because of the use of regeneration harvest methods and the greater number of acres that will be harvested under this alternative. Figure 12 identifies the number of acres that would be harvested under clear-cut prescriptions in each alternative. Over the next two years, this alternative provides the greatest benefits to species utilizing early-successional habitats.

Alternative 2 - CASPO

Management of the owl under the recommendations of the CASPO Report would provide less habitat in early-successional forests. However, even under this alternative some existing late-successional forest currently under timber sale contract will be harvested by clear cut methods, creating early-successional habitat. In addition, habitat harvested under the guidelines of Alternative 2 will create small patches of regenerating forest that would be utilized by some early-successional wildlife species. Wildfires will continue to convert older forest to early-successional habitat over the next couple of years. Given the existing drought conditions and high fuel loading, the amount of acreage burned in stand-replacing fires is expected to be higher than normal over the next two years.

Alternative 3 - Modified CEA Process

This alternative will result in conversion of the fewest acres of older forest to early-successional habitat. As with Alternative 2, implementation of this alternative over the next two years will not result in a shorage of early or mid-successional habitat.

Wildlife Associated with Late-Successional Forests

The California Wildlife Habitat Relationships Database (Appendix B) identifies over 250 species of amphibians, reptiles, birds, and mammals that occur in late-successional forests on the west side of the Sierra Nevada. Since there are few studies of wildlife habitat relationships in older forests of the Sierra Nevada, most of the information on habitat relationships must be extrapolated from other areas.

Studies conducted in the Pacific Northwest have found that over 60 percent of the 104 species of wildlife within the range of the northern spotted owl are more abundant in late-successional forest habitat than younger forest habitat (Ruggiero et al. 1991). Species identified from the WHR database as having a strong association with late-successional forest habitats within the range of the owl include: northern flying squirrel, marten, fisher, Douglas squirrel, western red-backed vole, shrew-mole, northern goshawk, bald eagle, pileated woodpecker, hairy woodpecker, red-breasted nuthatch, brown creeper, golden-crowned kinglet, Hammond's flycatcher, pine grosbeak, evening grosbeak, and pygmy nuthatch. These species find high capability habitat for foraging, reproduction, and cover almost exclusively in late-successional forests.

Several predominant structural components are important to the function of older forests: large trees, large snags, large logs, and a more diverse and multi-layered canopy (Franklin, 1981). Specific descriptions of these components as they occur in the Sierra Nevada mixed conifer and true fir forests are defined in Draft Old Growth Definitions (Fites 1992, Potter 1992). Many species are strongly associated with older forests due to their dependence on one or more of these predominant structural components. The amount of

habitat containing older forest characteristics has been declining over the past century throughout the Sierra Nevada, as described in the discussion on owl habitat abundance.

Fragmentation of late-successional forest habitat is an important consideration for wildlife associated with late-successional forests. Large, contiguous habitat blocks are recommended to maintain populations of species that are adversely affected by forest edge. The size, shape, and the amount of connectivity or isolation between patches of late-successional forest habitat are important to consider in evaluating the effects of fragmentation.

It is necessary to provide areas of interior late-successional forest habitat that are sufficiently large and unfragmented to reduce the effects of edge. The magnitude of edge effects may be minimized, however, by reducing not only the number of younger forest patches but also by reducing the contrast between the younger forest patches and the older forest habitat. Connectivity and spacing between blocks of late-successional forest habitat is of particular concern for terrestrial species with limited dispersal capabilities.

Several basic principles of conservation biology are summarized in the Tahoe National Forest's Recommendations for Managing Late-Seral-Stage Forest and Riparian Habitats (1992), and are important considerations for species associated with late-successional forests:

1. Species that are well distributed across their range are less prone to extinction than those restricted to a portion of their former range.

2. Large blocks containing many pairs of each species will sustain species better than small blocks with few individuals.

3. Contiguous, unfragmented habitats are better than fragmented areas.

4. Management strategies that provide habitat throughout the landscape are more able to withstand large disturbances than those that concentrate habitat.

5. Connected blocks of habitat will support more individuals than unconnected blocks, and blocks of habitat that are close together are better than those that are far apart.

Environmental Consequences

Alternative 1 - No Action

Acres in Late-Successional Forest Habitat

A minimum of 435,000 acres is managed in SOHAs as late-successional forest habitat in the Sierran province in accordance with existing draft and final Forest Land Management Plans. Forest Land Management Plans provide a discussion and analysis of this issue for each National Forest, and provide varying amounts of habitat in a variety of land allocations. In general, this alternative will provide the least amount of habitat in late-successional forest.

Fragmentation

SOHAs may be separated from one another by as much as 12 miles, allowing these blocks of late-successional habitat to become isolated and remain as unconnected patches in a matrix of younger successional-stage patches. Under the even-aged harvest prescriptions described in Forest Plans, habitat surrounding SOHAs can become fragmented, making dispersal more difficult for species which utilize the late-successional habitats. In general, province-wide, this alternative will provide little connectivity between blocks of older forest habitat.

Areas being managed as late-successional forest habitat provide habitat patches of varying size. Within SOHAs, 1,000 acres of habitat is managed to provide mature or old-growth characteristics. This is comprised of two contiguous blocks of habitat at least 300 acres in size, and the remaining 400 acres of habitat must be in patches no less than 60 acres in size. Not all SOHAs currently have 1,000 acres of suitable habitat. Where the minimum size patch is not met or exceeded, SOHAs may not provide a large amount of interior forest habitat free from edge effects.

Habitat Structure

In 1993 and 1994 an annual green harvest of about 9,900 acres would occur under even-aged management prescriptions. Structural elements important to late succession habitats will be removed. Outside of SOHAs or other areas set aside to provide mature forest habitat, this alternative provides little provision for maintaining the old-growth structural components found to be most important to the function of these forests as wildlife habitat.

Alternative 2 - CASPO

This alternative is not designed to provide large blocks of unaltered old-growth habitat, however it focuses on retaining many of the structural elements of mature forest habitat throughout the landscape. SOHAs would be maintained, PAC's created around all known nest sites and substantial changes would be made to harvest prescriptions across most of the landscape.

Acres in Late-Successional Forest Habitat

This Alternative will maintain substantially more late-successional habitat than will Alternative 1. As described in the "Effects" section for the spotted owl, Alternative 2 will result in an anticipated harvest of 4,760 acres of late-successional habitat over the next two years. This harvest will reduce canopy cover but retain many of the other structural elements of older forest habitat.

In addition to SOHAs, 300 acres of the best mature forest habitat available would be managed surrounding each known owl site. Given the 792 known spotted owl sites that are outside of SOHAs, this requirement would add an additional 237,600 acres of habitat to be managed as late-successional forest. This is in addition to the 435,000 acres in SOHAs.

Fragmentation

This alternative maintains the best 300 acres of late-successional habitat surrounding known owl sites. To the extent that some of these 300-acre PACs connect with other areas managed as old-growth habitat (SOHAs, Streamside Management Zones, Fisher Management Areas, etc), they may provide some larger blocks of habitat and help to reduce the effects of fragmentation. However, for the most part, it may result in the creation of "islands" of late-successional forest that are surrounded by managed stands containing structural components of late-successional forest (large trees, snags, and logs).

Fragmentation effects within late-successional forest habitat would be considerably less than those described for Alternative 1. Blocks of unaltered late-successional habitat will not be separated by as great a distance, thus reducing the degree of habitat isolation and increasing the likelihood for successful dispersal of wildlife. The retention of old-growth forest attributes throughout the landscape, should reduce the effects of fragmentation by reducing the contrast between older forest patches and the surrounding landscape. This alternative will maintain a continuity of large trees throughout the landscape and will preserve some decadence and down woody materials.

In terms of these ecosystem components, this alternative does not fragment the landscape. This alternative does cause fragmentation of a continuous, dense canopy closure. The Technical Team describes three

reasons why they are not concerned about the fragmentation of the understory canopy layer that would occur under the CASPO recommendations: (1) it is clear that historically the understory of white fir and incense cedar was discontinuous, (2) this habitat component can return quickly, and (3) creating this type of fragmentation can help avoid larger scale fragmentation of the overstory due to catastrophic wildfire.

Habitat Structure

As previously mentioned, retention of the largest trees, snags, and down logs will maintain many of the predominant structural components that are important to the function of old-growth forests. Species that are dependent upon these stand components may continue to utilize these habitats despite the reduction in overall canopy closure and removal of the understory layer. The number of large trees remaining following harvest of an "average" mixed conifer stand under the requirements of this alternative, is not substantially different from this structural element within old-growth mixed conifer forests (Appendix B). Based upon data for average stand characteristics on the Tahoe National Forest, this Alternative would retain about 18 large trees per acre within Selected strata and 8 to 10 large trees per acre within Other strata. An average of 10 to 13 large trees per acre are found within mixed conifer old-growth stands (Fites, et.al. 1992).

Species which are associated with a well developed understory will experience some habitat loss under this Alternative. Effects would certainly be reduced, however by the requirement to maintain a minimum of 40 percent canopy cover within the highest capability habitats (Selected strata). In particular, dispersal and movement abilities through harvested stands should be much greater than would be the case under Alternative 1.

Alternative 3 - Modified CEA Process

Alternative 3 would have the same beneficial effects as described for Alternative 2, and would maintain greater amounts of habitat as dense canopied, multi-storied stands.

Acres in Late-Successional Forest Habitat

This alternative will maintain additional late-successional habitat in an unaltered state. As described in the "Effects" section for the owl, Alternative 3 will result in an annual green harvest of about 7,290 acres. Very little of this would be late-successional habitat, however.

As in Alternative 2, this alternative will retain habitat within SOHAs and retain the best 300 acres of habitat surrounding all known nest/roost sites. In addition, in the mixed conifer zone this Alternative would retain about 2,500 acres of suitable owl habitat within each owl use area (or all that is available where less than this amount exists). In the red fir zone, up to 6,800 acres of suitable habitat would be retained within owl use areas. As previously discussed for spotted owls, within the mixed conifer zone this requirement is likely to retain about 90 percent of the existing suitable spotted owl habitat (M4G, M4N, M3G, M3N strata) in an unaltered condition. Since the density of spotted owl sites is lower in the red fir zone, there may be more opportunity for harvest within this type.

Fragmentation

This alternative will maintain most of the existing late-successional habitat surrounding known owl sites. Given the fairly even distribution of spotted owls through the mixed conifer zone, the result is that most existing late-successional habitat will not be altered.

Little fragmentation of existing late-successional habitat would occur under this alternative. In addition the same requirements applied in Alternative 2 which maintain many of the structural components of old-growth systems throughout most of the landscape, would apply. This would avoid increasing existing

patterns of habitat fragmentation by maintaining a continuity of large trees across the landscape, even within stands that currently have less than 40 percent canopy closure. Because Alternative 3 would not reduce fuel ladders to the extent that harvest under Alternative 2 would, and because this Alternative would not generate as much funding for fuels treatment, fragmentation of overstory components could actually be increased in the long term due to catastrophic wildfire. The additional risk is difficult to quantify, however.

Habitat Structure

Harvest that would occur under this alternative would involve the same guidelines applied in Alternative 2. Because few acres of late-successional habitat would be harvested, the existing habitat structure, including the understory component, would generally remain unaltered within these stands. Information contained in the CASPO Report indicates that the existing structure of these stands may not be similar to historic stand conditions. Historically, typical old-growth stands were more open and composed of larger, older trees with less of an understory component and fewer of the shade-tolerant species. This would have varied in response to a number of conditions, with moister sites resembling, more closely, the dense canopy and understories evident today.

It is quite possible, therefore, that maintaining the existing dense stand conditions throughout all late-successional forest may not be the best alternative to provide for the maintenance of all species associated with late successional forest habitat. It is likely that the best option for the maintenance of all native species is to provide the forest structure that those species traditionally inhabited. Alternative 2 comes closer to meeting this goal than Alternative 3.

Threatened, Endangered, and Sensitive Species

Effects to Threatened, Endangered, and Sensitive Species have been analyzed in a Biological Evaluation (BE) prepared for this project (Appendix C). The biological evaluation concludes that adopting any one of the three alternatives will not adversely affect threatened or endangered species nor result in a trend toward federal listing for species other than the California spotted owl. Project-specific evaluations are needed to analyze the effects of implementing any of the alternatives on a project specific basis. The BE describes management considerations for project design to take care of other species needs. Implementaion of interim standards and guidelines for the California spotted owl will not affect existing guidelines for other threatened, endangered or sensitive species.

Watershed, Soils and Fisheries

Issue: How will alternatives affect the watershed, soils and fisheries resources?

****Key Indicators: Relative compaction, erosion, runoff, retention of large trees and snags**

It is not possible to describe the watershed situation in detail because it is so varied across the Sierra Nevada, but it is possible to describe some of the effects of various harvest methods by alternative. For the purposes of this analysis, group selection, while a regeneration harvest method, is considered a partial harvest due to the limited size of openings created.

Alternative 1 (No Action) allows a full range of harvested options and approximately 22,310 acres are projected to be harvested per year for the next two years. This total consists of approximately 8,970 acres of regeneration harvests (clearcutting and shelterwood seed cuts), and 13,450 acres of partial harvests (overstory removal, group selection, commercial thinning and sanitation). Alternative 2 (CASPO) projects approximately 24,940 total acres to be harvested yearly, consisting of 5,070 acres of regeneration harvests and 19,870 acres of partial harvests. As discussed previously, the acres of regeneration harvests (in both Alternatives 2 and 3) result from "carryover" from the CEA process, and from harvests outside of suitable

owl habitat. Alternative 3 projects approximately 18,630 total acres to be harvested yearly, consisting of 4,630 acres of regeneration harvests and 14,000 acres of partial harvests.

Clearcutting and shelterwood harvests tend to result in less relative compaction because, in tractor harvest situations, logs may be skidded from fewer tractor positions and the machinery does not have to move as much to protect residual trees. However, these harvest methods can increase overall erosion and runoff (which has associated negative effects to fisheries) because there is not an effective overstory to intercept rainfall. This is despite the trend to leave some reserved stocking in the clearcut prescription.

Prescribed mitigation measures can limit these negative effects, but they are not usually 100 percent effective. Therefore, these regeneration harvest methods, which increase soil exposure to rainfall, increase the chance of erosion and produce increased runoff. The reduction in the number of skid trails needed, is as stated, a beneficial effect, but one that is negated by the negative effect of the exposure of bare ground.

Partial cutting methods (overstory removal, group selection, commercial thinning and sanitation-again, not applicable to salvage harvests) in tractor harvest situations tend to result in more relative compaction because the skidding equipment has to maneuver over a greater percentage of the stand to access cut trees and to avoid and protect residual trees. This situation occurs even with designated skid trails. Compacted soil decreases soil productivity and the compacted nature of the soil where the equipment passed tends to increase runoff and erosion. However, the remaining overstory tends to intercept rainfall, which decreases these runoff and erosion effects. The overall effect of partial cuts is to reduce impacts to the watershed resource. Where cable logging occurs, the compaction element is not present.

Alternative 2 projects more acres of harvest than Alternative 1, however Alternative 2 projects 3,900 fewer acres of clearcutting and shelterwood harvest. This will result in lessened overall watershed effects and should make Alternative 2 more beneficial to the watershed, soils and fisheries resource than Alternative 1.

Alternative 3 has the lowest number of acres of harvest scheduled. Owl use areas which can be partially harvested in Alternative 2, generally cannot not harvested at all in Alternative 3. Outside owl use areas and surplus habitat, all Forest Plan-allowed harvest methods can be utilized, although this doesn't amount to very much ground (approximately 74% is considered suitable and 26% is considered unsuitable, according to CASPO definitions). Alternative 3 has 4,340 fewer acres projected of regeneration harvests than Alternative 1 and 430 fewer acres than Alternative 2. Because Alternative 3 harvests the fewest acres and in particular, harvests the fewest acres using the clearcutting and shelterwood harvest methods, this alternative has the least impact to the watershed. Note that these numbers will not exactly match Figure 12 numbers because overstory removal is broken out for this discussion.

Transportation Systems

The Sierran National Forests are over 90 percent roaded (refer to the Transportation/Roads/Recreation portion of this section and to Appendix E). Due to rising prices for timber caused by restricted supply, it may be economical to build at least local roads even with the lower value associated with smaller diameter trees. However, it is likely sale economics would still not be as favorable for road construction as would the No Action Alternative. It is likely that many, if not most timber sales within the interim period would use existing road systems.

The fewer miles of road built, the lower the impacts to the watershed. Reconstruction will be necessary on many sales. The Scientific Panel on Late-Successional Forest Ecosystems (1991) "Alternatives for management of late-successional forests of the Pacific Northwest-A report to the Agricultural Committee of the U.S. House of Representatives" states that road construction causes the most erosion concern for fisheries. The

implications are that the action alternatives, with less predicted road construction, will be beneficial both from a watershed and from a fisheries standpoint.

Road reconstruction typically includes repair or construction of drainage features which decreases runoff and erosion. Road reconstruction is beneficial in all alternatives. To the extent that predicted harvest acres are highest in Alternative 2, less in Alternative 1 and much less in Alternative 3, probable road reconstruction miles will decline in that order.

Because the total harvest, and associated road program is the smallest, Alternative 3 has the least impact to the watershed resource. However, the No Action Alternative, because in part of the higher per acre volume, would likely be associated with the largest road program. Alternative 2 should be closer to Alternative 3 in predicted road program, than Alternative 1. However, the road program, as discussed here and in the transportation portion of the EA, is relatively small compared to historic levels. In other words, although there are differences between the alternatives in miles of roads that may be constructed or reconstructed, these differences are not very large when compared to past years when the road construction program was much larger.

Alternative 1 provides for a variety of streamside management standards and guidelines. All the Sierran Forest Plans, except for the Sequoia, allow some timber harvest within streamside management zones (SMZs).

Alternative 2 (which retains large trees over 30 inches dbh and most snags over 30 inches dbh and also has canopy cover restrictions) would provide additional protection to the fisheries resource to the extent that Selected and Other strata overlap the SMZs. The retention of the large trees and snags within the SMZs would provide additional stream shading, and recruitment for large woody debris.

Alternative 3 (which typically results in no harvest allowed within owl use areas) would benefit fisheries to the extent that the owl use areas overlap SMZs. Outside of the owl use areas, within Other strata, the Modified CEA process also retains the large trees and most large snags. To the extent that the Other strata overlaps streamside management zones, this Alternative would benefit fisheries with large woody debris and streamside shading.

Archaeology

Surveys for archaeological resources are accomplished prior to project approval. Timber sale contract provisions designed to protect archaeological resources are included in timber sale contracts. However, there is a potential for effects on this resource when ground-disturbing projects are implemented.

Effects can be predicted based on the number of acres accessed or harvested by the alternatives. If the acres harvested are increased, a broader area of archaeological survey will be required. The likelihood of encountering unrecorded resources during harvest will also increase, again because of the higher number of acres. If prescribed burning is increased, then more attention will have to be paid to management needs for historic resources that may be affected by burning or to archaeological resources that could be affected by fire containment activities like building fire lines.

Potential effects of the alternatives are proportional to the number of acres accessed on an annual basis. As Alternative 1 projects harvests of 22,310 acres annually, Alternative 2 projects harvests of 24,940 acres annually and Alternative 3 projects harvests of 18,630 acres annually Alternative 2 has the most potential effects and Alternative 3 the least potential effects.

With increased survey acreages, there may be a result of more sites recorded, and more opportunities for recreational use of those sites (e.g. interpretation of historic mines or mills). This could have implications for the use of Knutsen-Vandenberg (KV) funds (funds collected from the timber purchaser for post-sale

improvement of the sale area). Reforestation is the first priority for use of KV funds, however with Alternatives 2 and 3, reforestation should not be necessary as often. This could free up dollars to do other work, such as archaeological interpretation projects. However, because the timber sales in Alternative 2 and 3 should have less value and be more expensive, these funds may be very restricted. It is not possible to accurately predict if Alternative 2 and 3 will change availability of KV funding for this resource.

Visual Quality

Alternative 1, current Forest Plan visual quality objectives (VQOs) would still be in place. These VQOs vary from Preservation, where only ecological change is allowed, to Maximum Modification, where activities may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background. Timber management activities are allowed in all but the Preservation areas.

To the extent that Alternatives 2 and 3 reduce regeneration harvests (clearcutting and shelterwood methods), it is likely that a higher visual quality objective level will be achieved. Particularly in areas where the current Forest Plan VQO is Modification, a level of Partial Retention or Retention may be achieved. Where the VQO was already Partial Retention or Retention, there were already indirect restrictions on the kind of harvest methods used, as it was difficult (though possible) to achieve these "higher" visual quality standards with clearcutting and shelterwood methods anyway.

Alternative 3 would produce improved (or more natural-appearing) visual quality to the extent that no harvest is generally allowed within owl use areas. Outside of the owl use areas, within Other strata, effects would be the same as for Alternative 2.

Clearcutting is a controversial harvest method, particularly as it affects visual quality. The reduction in clearcutting in Alternatives 2 and 3 will be preferable to many members of the public.

Transportation/Roads, Recreation, Released Roadless Areas

****Key Indicator:** **Potential trends in road construction and reconstruction**

The primary way a change in forest management can affect the current recreation program is to affect visual quality, which was discussed previously, and to affect road construction which may have associated effects to released roadless areas. Released roadless areas are areas that were considered as part of Roadless Area Review and Evaluation (RARE) II for potential wilderness designation and are now released for multiple use management. Some members of the public are concerned about the effects of the action alternatives on released roadless areas (greater than 5,000 acres). Public concerns are that the action alternatives may make it more likely that released roadless areas would be entered, because of the lower volume per acre that may be harvested (Alternative 2) and/or the reduction of the number of acres that can be harvested in certain areas (the typical result of Alternative 3).

These released roadless areas are very variable throughout the Sierran National Forests. Although some are isolated, and contain low-value or only scattered timber, others are well-stocked with commercial timber and are less isolated. Potential effects on released roadless areas should be prefaced by a discussion and analysis of the general transportation program in the affected National Forests. The road construction and reconstruction program was introduced in the Watershed, Soils and Fisheries portion of this section, and will be discussed in more detail here.

The Regional road program has been designed to complete the undeveloped part of the forest development transportation system (arterial and collectors) and upgrade existing substandard roads. The Region's intent is to meet resource and administrative transportation needs. The Forests build three types of roads: 1) Arterials-high standard roads that are normally paved and double laned; 2) Collectors-roads that funnel traffic from local projects to the arterials; and 3) Locals-roads that have the lowest construction

standards. Locals are project roads built within timber sale areas to reach unaccessed timber stands. Locals are often dead end roads that are maintained for the life of the project, then closed until they are needed for future use.

Most Sierran National Forests are well roaded, except for the Sequoia. This means that the arterial and collector road system is nearly complete, except for the released roadless areas. In the commercial timber areas, the primary transportation system need is for local roads.

Refer to the Appendix E for more detailed information about recent road construction and reconstruction (FY 91). There are eight National Forests in the analysis area that have a substantial timber program, and associated transportation program. They are the Eldorado, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus and the Tahoe. Fiscal Year 91 averages are provided to display the most current information available (information from 91 TSPIRS report). On the eight National Forests, there was an average of 6.3 miles of new road construction last year. All new construction was paid for with purchaser credit, which is credit earned by a purchaser's construction or reconstruction of roads specified in the timber sale contract. Purchaser credit is used in place of cash for advance deposits for timber payment. There was a Sierran Forest average of 2.6 miles of reconstruction paid for with appropriated funds, and an average of 19.8 miles paid for with purchaser credit.

Reconstruction has positive effects to other resources, particularly the soils, watershed and fisheries resources as it is used (in part) to improve road features such as drainage and erosion control measures. Fiscal Year 91 was not a typical year, as salvage harvest (which usually involved lower value products) was most economical from existing road systems. Therefore, there was less road construction than probably would have occurred in a year with more green timber sold.

In all alternatives, non-timber Standards and Guidelines will still be applicable. These Standards and Guidelines affect management of riparian areas, protection of meadows, visual quality, old-growth dependent species, and other resources.

Alternative 1 - No Action

There would be no change in the current, Forest Plan scheduled timber sale program, and no change to potential effects to unroaded areas.

Alternative 2 - CASPO

Green and salvage timber harvest is allowed on all lands except PACs. Due to the restricted volume, it is likely that timber prices would rise, making road building somewhat more cost-effective, however, this price rise would probably not compensate for the drop in value associated with the drop in average diameter harvested. Recent sale information implies a rising product value ($270 to over $600 per MBF in recent sales). Sales may be cost effective, even with CASPO-recommended diameter and basal area restrictions. Helicopter logging (which costs approximately $200-$250 per MBF) may be economically feasible. Refer to the timber resource/economics discussion. It is not possible to project with any certainty whether it would be more or less likely that roads would be built in released roadless or unroaded areas.

However, the controversy surrounding road-building in these areas would continue, making helicopter logging an attractive practice (even though it is much more expensive than tractor or cable logging) no matter which alternative is selected. The other primary reason that roading released roadless areas is probably less likely is because of the high cost of arterial roads. These major roads would probably be necessary for initial entry into some roadless areas. The higher value of trees due to limited availability, may pay for local and even collector road construction, but would be less likely to pay for construction of arterials. Helicopter logging would still be a likely preferred harvest method in many cases. Note that

helicopter logging methods usually necessitate some road construction, however, this construction is usually minor.

Alternative 3 - Modified CEA Process

This alternative typically allows no harvest, or very limited harvest within owl use areas. To the extent that owl use areas overlap released roadless areas, no road construction or very limited reconstruction would occur. Outside of owl use areas, in the Other strata, effects would be the same as in Alternative 2. Owl use areas, and Other strata comprise most of the commercial timber land base, therefore, there are no effects outside these areas.

Alternatives 2 and 3 both result in decreased volume per acre and reduced product size. This could result in an increased harvest level even within the short time period of the interim guidelines, in the eastside pine areas. To the extent that released roadless areas exist in the eastside pine zone, there could be an increased possibility that these areas would be harvested.

SECTION V - INTERDISCIPLINARY TEAM

INTERDISCIPLINARY TEAM

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ADDITIONAL CONSULTATION

The ID Team worked closely with members of the Technical Team to clarify understanding of portions of the CASPO Report. Also, the ID Team exchanged information with the Policy Implementation Team on a frequent basis.

The ID Team also worked closely with Sierran Forest Timber Management Officers, with Forest Biologists, and with Forest Public Information Staffs on this analysis.

APPENDICES

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APPENDIX A

APPENDIX A

Abbreviations and Acronyms

ASQ	Allowable Sale Quantity
CSO*	California spotted owl
CASPO Report	California Spotted Owl Report
CEA	Cumulative Effects Analysis
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
dbh	Diameter Breast Height
ESA	Endangered Species Act
FSH	Forest Service Handbook
FSM	Forest Service Manual
HCA	Habitat Conservation Area
ID Team	Interdisciplinary Team
ISC	Interagency Scientific Committee
IMPLAN	Forest Service Input-Output Economic Model
KV	Knutson - Vandenberg Act of 1924
MBF	Thousand Board Feet
MCF	Thousand Cubic Feet
MMBF	Million Board Feet
MMCF	Million Cubic Feet
NEPA	National Environmental Policy Act of 1969
NF	National Forest
NFMA	National Forest Management Act of 1976
PIP Team	Policy Implementation Planning Team
PSW	Pacific Southwest Forest and Range Research Station
R5	Forest Service Pacific Southwest Region
SOHA	Spotted Owl Habitat Area
Steering Committee	Interagency Steering Committee
Technical Team	Technical Assessment Team
USDA	United States Department of Agriculture

*In this environmental assessment, any reference to "owl" or "spotted owl" refers to the California spotted owl, within the Sierran Province unless specifically identified as another species or subspecies.

APPENDIX A

Glossary

Activity center:	The most recent and best location for an owl, based on owl status (for example, reproductive pair, pair, or resident single), year, time of day (night vs. day) and season (breeding vs. nonbreeding).
Activity fuels:	Fuels resulting from, or altered by, forestry practices such as timber harvest or thinning, as opposed to naturally created fuels.
Adaptive management:	The process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans.
Allowable sale quantity:	The quantity of timber that may be sold from the area of suitable land covered by the Forest Plan for a time period specified by the Plan. This allowable sale quantity (ASQ) is usually expressed on an annual basis as the "average annual allowable sale quantity." (FSM 1900)
Basal area:	The area of the cross-section of a tree stem near its base, generally at breast height and inclusive of bark.
BD (Brush disposal):	Funds deposited by purchasers of National Forest timber to be used to dispose of brush and debris resulting from the cutting operation. It is used to treat the brush or provide protection in lieu of treatment.
Biomass:	The boles, tops, limbs and foliage of trees. Also, whole tree removal of boles, tops and limbs (colloquial). Removal of logging residue (slash) and cull logs may also be included.
Canopy closure (cover):	The degree to which the crowns (branches and foliage) of trees are nearing general contact with one another, usually expressed as the percent of area that is covered by a vertical projection of the tree crowns. When crowns of all adjacent trees touch or overlap completely this is defined as 100 percent canopy closure. In contrast, at 50 percent canopy closure, half of the area between adjacent trees is open space devoid of tree crowns. Canopy closure is generally used to refer to the canopy cover resulting only from trees (conifers and hardwoods).
Cull:	A tree that does not meet utilization (merchantability) standards because of disease, defect or form.
dbh:	Diameter of a tree at breast height (4 feet, six inches above the ground on the uphill side of the tree), typically measured in inches.
Dispersal:	The movement, usually one way, and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.

Early seral:	Plant and animal communities developing on a forest site soon after a major disturbance, such as wildfire or timber harvest, removes most of the pre-existing vegetation; characterized by grass, forbs and shrubs. Generally considered to last between five and fifty years following the disturbance. (See Succession, Sere)
Edge effects:	Differences in microclimate, flora, fauna, stand structure, habitat values, stand integrity (including resistance to being blown down by high winds) that occurs in or as a result of a transition zone where two plant communities or successional stages are joined.
Fine fuels:	Fast drying dead fuels, generally characterized by a comparatively high surface area-to-volume ratio, which are less than 1/4 inch in diameter and have a time lag of one hour or less.
Fire hazard:	A fuel complex, defined by volume, type, condition, arrangement and location that determines the degree of ease of ignition and of resistance to control.
Fire regime:	Characteristic fire return interval and fire behavior for a natural fuel complex.
Floaters:	Nonbreeding adults and subadults that move and live within a breeding population, often replacing breeding adults that die; nonterritorial individuals.
Fragmentation:	Process of reducing the size and connectivity of stands that comprise a forest.
Fuel loading:	Oven dry weight of fuel per unit area, usually expressed as tons per acre.
Fuel management:	The act or practice of controlling flammability and reducing resistance to control of wildland fuels through mechanical, chemical, biological or manual means, or by fire, in support of land management objectives.
Fuel treatment:	Any manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.
Fuel ladder:	Dead or living fuels which connect surface fuels to tree or brush foliage and promote spread of fire from ground to vegetation crowns.
Fuel loading:	The amount of combustible material present per unit area, usually expressed in tons per acre.
Fuels:	Combustible materials.
Hypogeous fungi:	Below ground fruiting bodies of fungi, known as true and false truffles, which are an important part of the flying squirrel's diet.
Interdisciplinary Team:	A group of individuals with varying areas of speciality assembled to solve a problem or perform a task.

Land Management Plan:	A plan written for the management of a National Forest unit, as directed by regulations of the National Forest Management Act of 1976, in which the integrated management of all major resources has been determined through an interdisciplinary team process.
Late seral:	Plant and animal communities existing near the final (ecological climax) stages of development of a forest; characterized by large, old trees. Generally considered to last between several decades and a few centuries. (See Succession, Sere)
Mean fire interval:	Arithmetic average of all fire intervals determined, in years, in a designated area during a specified time period; size of the area and the time period must be specified.
Natural fuels:	Fuels resulting from natural processes and not directly generated or altered by land management practices.
Owl site:	An area of unspecified dimensions where a single owl or a pair of owls has been located, usually repeatedly. In demographic and radio-tracking study areas, where efforts to locate all owls are more intense than elsewhere, most owl sites with single owls have eventually been found to have a pair. All owl sites have been mapped and given unique spatial references, so they can be tallied. Designation of an owl site makes no assumption about home-range or territory boundaries of the owls, although usually a center of activity can be identified by the location of a nest or a primary roosting area. The terms "owl site" and "site" are general and often used generically to refer to home ranges, territories, or to sites designated by agencies for special owl management.
Owl use area:	An irregularly shaped polygon that contains a known or predicted activity center and encompasses the amount of nesting and foraging habitats typically found within home ranges during the breeding season.
Potential habitat:	(1) Habitat that has been altered (for example, logged or burned) and is not presently suitable for owls byt is believed to have the potential to regenerate into suitable habitat; (2) Unsurveyed habitat that appears to be suitable based on comparisons with habitat elsewhere that has known owl sites.
Regeneration Harvest:	In the context of this document, the term is used to refer to clearcut and shelterwood harvest methods in which the basic objective is renewal of the tree crop either by planting or natural regeneration.
Reserved land:	Federal lands unavailable for timber yield or management due to being a National Park or classified as a Wilderness Area in a National Forest.
Sere:	An identifiable stage in the succession process.
Snag:	Standing dead tree, including trees with green foliage which show indicators of death within 6 months.
Succession:	The change, over time, in the biological community developing on a site beginning with bare soil or rock.

Suitable habitat:	An area of forest vegetation with the age-class, species of trees, structure, sufficient area and adequate food source to meet some or all of the life needs of a California spotted owl.
Total canopy closure: (cover)	Canopy cover by all vegetation 7 feet or higher above the ground, expressed as a percentage. This includes not only the upper canopy layer of trees but also the lower canopy layers of shrubs, saplings and poles.

APPENDIX A

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APPENDIX B

APPENDIX B

Forest Plan Snag and Dead and Down Table

National Forest	Snag Retention Guidelines	Dead and Down Guidelines
Eldorado	1.2 snag/ac 15-24" diam & >20' high 0.3 snag/ac >24" diam & >20' high	Retain 3 logs/ac at least 20" diameter at the large end.
Lassen	Av 1.5 snag/ac on forested land unit of 1000-5000 ac. w/snag characters meeting "medium" habitat requirement from habitat capability model.	Oak woodland/Eastside pine = 1.5 log/ac Mixed conifer, lodge-pole pine = 3 log/ac True fir, mountain hemlock = 4 log/ac Logs min. 30' long & 16" large-end diam
Plumas	1.2 snag/ac 15-24" diam & >20' tall & 0.3 snag/ac >24" diam & >20' tall. Prefer soft snags, culls & hard snag	Maintain mgmt. area ave of 320 cu.ft/ac in slash/down logs w/50% of volume in pieces >8' long w/ min. diameter of 20"
Sequoia	100 hard snag/100 ac 15-24" diam & >20' tall plus 50 hard snag/100 ac >24" & >20' tall	Retain 132 cu.ft/ac. Ideal log 20" diam & 20' long. Retain lrg decomp logs if consist w/other mgmt. Keep 10% slash.
Sierra	In each compartment maintain av 1.5 hard snag/ac 15-24" DBH & >20' high & 0.5 hard snag/ac >25" DBH & >20' high	Retain av 3 down log/ac at least 20" diameter & 20' long in various stages of decomposition.
Stanislaus	Where mgmt emphasizes spotted owls- retain 1-2 hard snag/ac 15-24" DBH & >20' high & 2+ snag/ac >25" DBH,>20' high; stds less in General Forest.	Where mgmt emphasizes spotted owls - retain 3 log/ac 15-30" diam & 20+' long same stds-applies in General Forest areas.
Tahoe	1.2 snag/ac 15-24" DBH & >20' tall & 0.3 snag/ac >24" DBH & >20' tall. In westside compartments goal of 2 snags/ac. Provide for recruitment.	Av 5+ log/ac. Up to 20 log/ac retained if no conflict. Prefer >20" diam & >40 cu.ft in vol. If lrg logs absent retain 200-800 cu. ft in small logs, slash etc.

APPENDIX B

Old-growth Structural Characteristics

Structural characteristics of old-growth mixed conifer forests (SAF Type 243) by Dunning's site classes.

	MIXED CONIFER		
	Site 1A-1	Site 2-3	Site 4-5
NUMBER OF SAMPLES	122	58	23
DBH OF LARGE TREES (inches)	39+	39+	29+
NO. LARGE TREES (Trees/acre)			
Mean	13	10	11
S.D.	5.6	4.4	5.9
Range, low	8*	6*	5*
Range, high	18*	17*	17*
VARIANCE OF TREE DIAMETERS			
Median	100	90	67
CANOPY VARIATION1/			
No of Layers	2-4 2/	2-3 2/	2-3 2/
AGE (Years)			
Mean	285	351	323
S.D.	84	109	69
Range, low	188*	253*	256*
Range, high	408*	483*	450*

1/ The four canopy layers are: 70-100% of the dominant canopy layer height, 40-69% of the dominant canopy layer height, <39% of the canopy layer height (excluding the generation layer), and the generation layer (trees <4.9" dbh).

2/ Best professional judgment used to estimate the canopy variation, using ecology plot data and field observations.

* Calculated from the 15 and 85 percentiles.

** Calculated from the 10 and 90 percentiles.

Structural Characteristics of old-growth mixed conifer forests (SAF type 243) by Dunning's site classes.

MIXED CONIFER
Site 1A-5

	SNAG DENSITY 3/ (>29" DBH & > 10')	LIVE TREE DECADENCE 4/ (>29" dbh)
Mean	1.3	3.0
S.D.	1.6	2.2
Range	0-2.7*	1.2-4.8*
Number of Samples	45	47
	(>39" dbh & > 10')	(>39" dbh)
Mean	0.6	1.6
S.D.	0.9	1.7
Range	0-1.3*	0.7-3.1*
Number of Samples	45	47
	LOG DENSITY (10-20" DIAM. & >10')	
Mean	18.4	
S.D.	32.2	
Range	0-39.0*	
Number of Samples	20	
	(>20" diam. & >10')	
Mean	13.5	
S.D.	7.0	
Range	0-20.2*	
Number of Samples	20	
	(>40" diam. & >10')	
Mean	0.9	
S.D.	1.5	
Range	0-2.2*	
Number of Samples	20	

* Calculated from the 85 percentile, except for 0 values.

3/ Note: snag densities may be underestimated due to the use of prism sampling technique for many of the plots; a technique known to underestimate snag levels.

4/ Decadence includes characteristics of live trees including: broken tops, spike tops, multiple leaders, conks, fire or other bole scars.

APPENDIX B

Summary of primary recommendations for stand retention and special stand treatments to maintain options for spotted owls on public timberlands in the Sierra Nevada during an interim period.

Attributes	Protected 1/ Activity Centers	Selected 2/ Timber Strata	Other 3/ Timber Strata	Salvage Sales
Large, old trees				
Basal area	No logging	Keep 40 percent, from largest healthy trees and culls	Keep 30 percent, from largest healthy trees and culls Retain at least 50 square feet pr acre	Does not apply
dbh 4/	No logging	≥30 inches	≥30 inches	Does not apply
Percent canopy cover	No reduction	≥40 percent	No restriction	No restriction
Snags	No reduction	Retain largest down to a total of 20 square feet per acre	Retain largest down to a total of 20 square feet per acre	Retain largest down to a total of 20 square feet per acre; take no snag ≥30 inches in dbh.
Dead-and-downed woody material	Retain at least 3-5 percent of ground cover; at least three logs 20 inches in diameter by 20 feet long	Retain at least 3-5 percent of ground cover; at least three logs 20 inches in diameter by 20 feet long	Retain at least 3-5 percent of ground cover; at least three logs 20 inches in diameter by 20 feet long	Retain at least 3-5 percent of ground cover; at least three logs 20 inches in diameter by 20 feet long
Fire threats	Light under-burning (see Chapter 12)	Positive fuels man-agement	Positive fuels man-agement	Positive fuels management

1/ Block of 300 acres of suitable nesting/roosting habitat delineated around nest site or primary roost site in all known spotted owl sites in the Sierra Nevada, as identified in the California Department of Fish and Game database.

2/ Timber strata selected for nesting by spotted owls in the Sierra Nevada (M4N, M4G, and better--strata codes explained in table 1C).

3/ Other timber strata used for nesting by spotted owls in the Sierra Nevada (M2G, M3P, M3G, M3N, M4P, R3P, R3G, R4G, R4N--strata codes explained in table 1C).

4/ Diameter at breast height, in inches.

APPENDIX B

Eastside Pine Timber Type and Habitat Range for the California Spotted Owl (CSO)

With completion of survey work for the California spotted owl over the past several years and increased research regarding the habitat needs of the CSO, most notably **The California Spotted Owl: A Technical Assessment of Its Current Status** (CASPO) by the Technical Team, the question has been raised as to what constitutes the habitat range for the California spotted owl.

Subsequent to completion of survey work in Fiscal Year 1992 many resource managers, including silviculturists, wildlife biologists, foresters, and project planners from various Sierran Forests, have inquired as to whether it is appropriate to consider extending the range for the CSO into what is commonly known as the "eastside pine timber type."

During a two-day meeting in Placerville on August 5 and 6, 1992, organized to discuss CASPO and its implications, Dr. Jared Verner, Technical Team Leader, expressed doubts as to whether the normal range of the CSO includes the pure eastside pine timber type. In subsequent communications with Dr. Verner, he stated that "... the number of owl sites on the eastside is small enough that it should be regarded as essentially a fringe area of the overall population. As such, its importance to the viability of spotted owls in the Sierra Nevada is minimal" (Personal Communication, October 29, 1992).

Throughout the 1992 Field Season, information-gathering trips were conducted on all the Sierran Forests by David Solis, Regional Spotted Owl Program Manager, John Robinson, Assistant Regional Spotted Owl Program Manager, and Mark Rentz, Regional Wildlife Coordinator for Timber Management. Inevitably, the question arose as to whether it was appropriate for the Forests to consider the eastside pine timber type within the habitat range for California spotted owls. Several of these visits included field trips to areas of eastside pine that had been surveyed for California spotted owl. Conclusions were consistent during these visits - owls were not found in pure eastside pine stands, but occasionally a single owl or pair were found in adjacent stands that were either predominantly mixed conifer or had a significant understory of mixed conifer.

In October, an informal data request was made by the Regional Office regarding survey work in the eastside pine timber type. The data provided by the National Forests located within the Sierran province (Inyo, Lassen, Lake Tahoe Basin Management Unit, Modoc, Plumas and Tahoe) is set forth in Table 1. In summation, the Forests have conducted owl surveys over approximately 205,000 acres considered to be eastside pine timber type. To date, four singles (pair status is unknown for two of these) and three pairs have been located. In responding to the data request, the Forests independently stated that sightings of California spotted owl in the eastside pine actually occurred in stands that had substantive components of a mixed-conifer timber type.

Based on the extensive survey work completed to date and the minimal number of California spotted owls located within the eastside pine timber type, it is unnecessary to require continued survey efforts for California spotted owl in the eastside pine timber type. Recognizing that owls may be present in adjacent stands exhibiting a sufficient mixed conifer attribute, exceptions need to be made for those areas that forest biologists believe may be utilized as habitat by the owl.

To provide the Forests with an initial baseline for determining what constitutes eastside pine habitat, refer to Enclosure 1 attached to the Regional Forester's letter dated October 28, 1991. That letter provides, in part, that suitable eastside habitat includes any stand with larger overstory trees and some type of understory (either conifer or hardwood) with a combined canopy closure greater than 50 percent.

For purposes of identifying a timber strata (like eastside pine), at least 80 percent of the canopy cover should be composed of the cover type species (for eastside pine, either ponderosa pine, or Jeffrey pine, in any combination with lodgepole pine as a minor component).

Table 1

COMPILATION OF SURVEY WORK COMPLETED FOR CALIFORNIA SPOTTED OWL (CSO) IN EASTSIDE PINE TIMBER TYPE, REGION 5

National Forest	Acres of Eastside Pine that are suitable for CSO	Acres of Eastside Pine surveyed for CSO 1/	Number of CSO located as result of surveys
Inyo	6,000	2,400	1 single 2/ 1 repr. pr. 2/
Lassen	15-20,000	75,000	1 pair, status unknown 3/ 1 single 3/
LTBMU	7,060	2,400	None
Modoc	20,000	92,000 4/	2 birds 5/
Plumas	35,000	24,000	1 pair 6/
Tahoe	7,960	10,000	None

1/ Includes unsuitable habitat located within the planning area for the proposed project and was surveyed along with suitable habitat to determine CSO presence within the planning area.

2/ Locations of CSO were in "mixed conifer" (red fir/Jeffrey pine).

3/ Locations of CSOs were stands with "high amounts of white fir present."

4/ 46,000 of this 92,000 acres consists of the "best CSO habitat" in the Warner Mountains of the Modoc NF.

5/ Both birds "were located in predictably suitable habitat containing both understory and overstory of white fir, with pine."

6/ The pair was detected in "an Eastside mixed conifer stand."

ATTACHMENT

CONSULTING WILDLIFE BIOLOGISTS

Ann Chrisney, Plumas National Forest
Sara Chub, Inyo National Forest
Diana Craig, Tahoe National Forest
Kathy Erwin, Lake Tahoe Basin Management Unit
Dawn Lipton, Eldorado National Forest
Tom Ratcliff, Modoc National Forest
Terry Simon-Jackson, Plumas National Forest
Gary Smith, Lassen National Forest
David Solis, Regional Spotted Owl Team Leader
Jared Verner, Team Leader, Technical Team

APPENDIX B

Questions and Answers on CASPO report:

RESPONSES TO MEMO #2 FROM POLICY-IMPLEMENTATION TEAM, 30 JUNE 1992

1. Question: What fuels practices should be allowed around owl nest sites?

   Answer: We believe that the public entities should carefully consider fuels management policies within these areas. We did not recommend any specific burn regime or fuels treatment, as this must be implemented according to conditions in each Protected Activity Center (PAC). Clearly, the burn policy should be designed to remove fuels without significantly impacting the stand structure or endangering the owls. This will require the coordinated input and planning of a variety of resource specialists.

   On a case-by-case basis, wildlife biologists and fuels management experts may advise implementing aggressive fuels treatment (for example, thinning of understory that has created fuel ladders, yarding of excess logs, piling and burning) on a given PAC. This may entail killing some trees <11 inches in dbh. We would be comfortable with snag and downed-wood guidelines down to the limit specified for Selected Timber Strata in Chapter 1 of our report, with the exception that no felling should occur within 300 feet of known nest trees, and no felling activity should occur in PACs from 1 March through 15 August (unless a given pair is confirmed not to be nesting in a given year), to avoid any chance of direct disturbance to nesting birds. In the case of National Forest lands, any plans for such action should have the approval of Regional wildlife and fuels specialists.

   The timing of prescribed burns in PACs needs further discussion vis-a-vis potential impacts on nesting birds. We see good reasons for spring burns to take advantage of moist conditions, but obviously burning should not occur too close to nesting birds. Of course, spring burns should be fine in PACs where owls are not nesting in a given year.

2. Question: Were pure pine stands on the western slopes of the Sierra Nevada intentionally omitted from "Selected Timber Strata" and "Other Timber Strata"?

   Answer: Pure pine stands were omitted from the list of nest stands (Fig. 5A) because we were originally unable to type labels accurately with the species composition. We found that many stands typed "P" had white fir in their species list. We therefore lumped them either into "M" or "H" types, depending on the species composition. After reviewing the data more recently, we have determined that 6 to 8 of 133 nest stands classified as mixed conifer are, in fact, pure pine. Based on this reanalysis, we have included P4G in "Selected Timber Strata" and P4N, P3G, and P3N in the list of stands subject to our recommendations for "Other Timber Strata." These changes have been incorporated in the final document, which is currently being prepared for publication as a General Technical Report by the PSW Research Station.

3. Question: Are there any minimum limits on cutting the largest trees in particular stands? For example, if an M2P stand has two large trees per acre (<30 inches in dbh), can they be removed?

   Answer: Yes, they could be removed from M2P stands. M2P was not included as a potential nest stand so was not subject to our recommendations. They could not be removed from

M2G stands, however. M2G is the only "2" strata so included. For M2G, the standards apply as they do for all other stands in the list.

4. Question: Please comment specifically on how the CEA process should be strengthened as an alternative for the short-term R5 policy.

Answer: As indicated in Chapter 1, we believe that the CEA process, if continued as a strategy, should contain provisions for retaining large trees, snags, and downed woody debris. Specifically, we would recommend following guidelines stipulated in our recommendations in Chapter 1. Note that following the CEA strategy will not change the likelihood of catastrophic wildfires for those areas covered, unless specific fuels-reduction procedures are included in prescriptions.

5a. Question: Question 5 is long and really includes at least 3 questions that require separate answers. The first seems to be asking for a clearer explanation of why an HCA approach was rejected in favor of the CASPO recommendations for an interim strategy.

Answer: We believe we have adequately explained in Chapter 1 our reasons for not opting for an HCA approach in the Sierra Nevada at this time. Here we emphasize the two primary reasons that relate to the fact that we have recommended an **interim** approach. First, implementation of an HCA strategy would immediately begin to erode options for maintaining owls in the landscape between designated conservation areas. This is patently at odds with our belief that we can and should find a strategy that allows a significant level of logging but maintains owls distributed widely and evenly throughout the Sierra Nevada. Second, an HCA approach does not, in itself, provide a mechanism for dealing with the current fire threat that we see so prevalent in most of the conifer forests of the Sierra Nevada. We do not believe that funding would be forthcoming to implement an aggressive fuels management program in an HCA, in which logging would be excluded.

5b. Question: This question asks for an assessment of the risk of fire danger to habitat in and outside of HCA's.

Answer: We are not experts in this field, so we cannot provide a complete answer to this question. Common sense suggests that fire danger will be greatest where surface and ladder fuels are the most fully developed--as we believe they would be in HCA's. Outside of HCA's, timber sales can be planned in ways that reduce fire danger, and revenues generated by the sales can be used to implement further fuels management projects. If current policies limit our ability to use timber revenues for this purpose, those policies should be reconsidered.

5c. Question: This question asks for an evaluation of the relative effects of the CASPO recommendations and an HCA strategy on other species, especially vertebrates, in terms of fragmentation.

Answer: Such an evaluation was not a part of our assignment. A thorough assessment of possible effects on other species would require several efforts comparable to that which we just completed for the California spotted owl. In a broad sense, however, we suspect that creating an array of old-growth islands could adversely affect inter-island movement by species with limited dispersal capabilities. We believe this effect would be minimized if old-growth forest attributes were uniformly distributed throughout the Sierra Nevada. For species that depend on intermediate or early successional stages

of forest development, we envision no shortage in the amount or distribution of their habitats under either scenario.

The forest structures generated by following our guidelines would be more similar to historic stand conditions (inferred from the scant literature of presettlement forest conditions) than are current stands (and landscapes). That is, they would be more open and composed of larger, older trees with a shift toward shade intolerant species. We would also expect different tree densities and plant species composition in response to exposure, topography, and soil conditions. If these stands are maintained in this open condition through periodic burning, they should approach natural, presettlement stand conditions. For the maintenance of all native species, probably the best hope is to maintain the forest structures that those species traditionally inhabited. We believe that the generation of more natural stand structures is one of the strong points of our recommendations.

Fragmentation occurs at various spatial scales. HCA's impose a large-scale fragmentation that may be suboptimal for species preservation where the current landscape is not highly fragmented. We were anxious to avoid the sort of fragmentation that exists over much of the range of the northern spotted owl.

At smaller scales, it is not clear that our recommendations would create greater fragmentation. They would maintain a continuity of large trees throughout the landscape and preserve large woody materials as well. In terms of these ecosystem components, the CASPO recommendations do not fragment the landscape. They do cause fragmentation of the continuous layer of understory white fir and incense cedar that currently covers much of the Sierra Nevada MC zone. We are not greatly concerned by this, however, as (a) it is clear that historically this layer was discontinuous, (b) it is easily recoverable (if we want it back, it will return quickly), and (c) by creating this type of fragmentation we avoid the fragmentation of the overstory components due to catastrophic wildfire.

6. Question: Please provide some guidance vis-a-vis CDF's evaluations of Timber Harvest Plans on private lands relating to nest sites and roosting habitat.

   Answer: We did not recommend implementing our strategy on private lands. We encouraged the implementation of plans such as Sierra Pacific's and considered these to be important management experiments. CDF will need to analyze THP's individually, based on the biology of the owl, as set forth in our report, as well as in other more diffuse sources cited therein. Decision makers will need to become thoroughly familiar with the owls and their habitat needs, then make decisions accordingly, on a case-by-case basis. This will no doubt require a stronger presence by Dept. of Fish and Game personnel in the review process to get more technical input from the standpoint of owl biology.

California Spotted Owl Technical Assessment Team.

Thomas W. Beck
Gordon I. Gould, Jr.
R. J. Gutiérrez
Kevin S. McKelvey
Barry R. Noon
Jared Verner

United States Department of Agriculture | Forest Service | PSW, Fresno

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7 December 1992

To: Dale Bosworth
Ed Whitmore
Chris Jauhola
DeAnn Zwight
Dawn Lipton
John Phipps
Duane Nelson
Jack Gipsman

Re: CASPO recommendations for snags and downed wood

This is to clarify a point made during our discussions last Wednesday that Kevin McKelvey and I think may be open to some misinterpretation. We agreed that a reasonable solution to the concerns (safety and future fire threats) about having up to eight snags per acre would be to put some of them on the ground as immediate contributions to the downed wood component. This acknowledges the facts (1) that many of the snags retained would not stand long anyway, and (2) that practically no downed wood survived the fire, so providing some large logs now would get the decay process underway sooner and also allow felling of the logs in positions on the landscape that would maximize their benefit.

Agreement to this option for the Cleveland burn area should not be interpreted to mean that we recommend a similar alternative in all cases. The CASPO recommendations for snags and downed wood should still be viewed as separate.

The burned area is an exception that clearly would benefit from exceptional approaches to management. The primary value of snags left standing in the burned area (vis-a-vis the owls) is their later contribution to the downed wood component in a regenerating forest. Secondarily, if some snags continue to stand for a few decades, they may survive long enough to provide nest sites for owls sooner than the new generation of trees could. In an intact forest, on the other hand, standing snags have several immediate values. In addition to providing some nest sites for the owls, they constitute the primary nesting substrate for a variety of cavity-nesting birds (some of which are taken as prey by the owl). And probably most important is the secondary use of nest cavities as den sites by flying squirrels--the principal prey of the owls in conifer forests above about 4,000 feet elevation in the Sierra Nevada.

The CASPO recommendations express the intent of the Technical Assessment Team in terms of maintaining options, during an interim period, for later implementation of a long-term strategy for the owl (and we hope other resources as well). Special circumstances may sometimes necessitate deviations from the strict letter of the recommendations. But if we can always justify those deviations rationally, and show that they still maintain the intent of the recommendations, we should be all right. Common sense should be our ultimate guide.

/s/ Jared Verner, Leader
Technical Assessment Team

cc Kevin McKelvey

Barry Noon
Tom Beck
Phil Weatherspoon

United States Department of Agriculture | Forest Service | PSW, Fresno

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19 October 1992

To: Diane McFarlane

Re: Salvage sales and CASPO recommendations

Your DG message of 14 October raised a question regarding our recommendations and the current timber salvage effort in Region 5. Specifically, our recommendations for Selected Timber Strata and Other Timber Strata state that they "may be entered only once for commercial logging prior to implementing a long-term strategy for managing the California spotted owl on public lands."

Your question: "Is the ongoing trimber salvage effort considered to comprise that one commercial entry?"

I've now discussed this with all members of the Technical Team, and we have reached a consensus on the following response"

> If recent mortality in a stand has changed its classification, and/or a salvage sale results in changing the classification of a stand from a Selected Timber Stratum to any other classification, including "Other Timber Stratum," the salvage operation in that stand should be regarded as the one commercial entry allowed under our recommendations before a final, long-term strategy is implemented for the owl. Otherwise, it need not be so regarded. We are assuming that the maximum allowable salvage is taken during this entry. In all cases, however, salvage sales should satisfy our revised recommendations for retention of snags and downed wood. In addition, we assume that only dead trees are removed during salvage sales, and that a sale administrator is diligent in assuring that this is the case.

/s/ Jared Verner

Jared Verner, Leader
California Spotted Owl Technical Assessment Team

APPENDIX B

Explanation of Changes to the CEA Process

The Cumulative Effects Analysis (CEA) process was developed with the intent of ensuring that projects would not eliminate or reduce future management options for the California spotted owl. A Regional Forester's memo, dated July 24, 1991, first described an outline of the analysis process. This guidance was revised and expanded in a memo issued October 29, 1991, which provides the current guidance for preparing Cumulative Effects Analyses for projects on the Sierran National Forests, including the Inyo, Modoc and Lake Tahoe Basin Management Unit (see attached).

The basic purpose of the CEA process is to identify known or suspected owl use areas, to identify the habitat within these use areas, and to determine if a project will eliminate or reduce habitat to a point that it is likely to affect spotted owls or spotted owl pairs. Conducting this process requires biologists to make several important determinations: (1) identification of an owl's use area, (2) identification of suitable habitat, and (3) determination of the amount of suitable habitat needed to support a pair of spotted owls. The process provides for these determinations to be made based on the best available information for a particular geographic area.

The CASPO Report provides additional data and information that should be considered in making these determinations, and which should revise some of the assumptions described in the October 29, 1991 memo:

1. Identification of an owl's use area: The current process delineates owl use areas as an area defined by a circle with a radius of 1.3 to 1.5 miles (3,500 to 4,500 acres). Based on information contained in the CASPO report, spotted owl use areas may exceed this by a considerable amount, particularly in the true fir habitat type. For this reason, habitat should be mapped within an area defined by a 1.3 to 2.5 mile radius circle around the activity center, depending on the habitat type. The use area should then be delineated based upon the distribution and amount of suitable habitat.

2. Identification of suitable habitat: The current CEA process defines suitable habitat as follows:

   a. West-Side habitat
      Nesting: greater than 70 percent crown closure, over half of which is in dominant, overstory trees, and the rest made up of trees 30 feet or taller (including hardwoods).
      Foraging: 50 percent or greater crown closure, with half of the canopy made up of dominant, overstory trees and the rest made up of trees 30 feet or taller (including hardwoods).

   b. East-Side habitat
      Potential suitable east-side habitat, particularly for the Modoc and Inyo National Forests, includes any stand with larger overstory trees and a conifer or hardwood understory with a combined canopy closure greater than 50 percent.

   Based on information presented in the CASPO Report (Chapter 6), this definition is modified in Alternative 3. The definition of nesting habitat on the west-side is appropriate based upon information in the report. Suitable foraging habitat appears to occur in more varied conditions than described in this definition, however. Owls were shown to select for stands with total canopy closure greater than 40 percent, and stands with less than 40 percent canopy closure were used less than expected based on availability. It is therefore appropriate to change the definitions of suitable habitat to the following:

   a. West-Side habitat
      Nesting: greater than 70 percent crown closure, over half of which is in dominant, overstory trees, and the rest made up of trees 30 feet or taller (including hardwoods).

Foraging: 40 percent or greater crown closure, made up of trees 30 feet or taller (including hardwoods).

b. East-Side habitat
Potential suitable east-side habitat, particularly for the Modoc and Inyo National Forests, includes any stand with larger overstory trees and a conifer or hardwood understory with a combined canopy closure greater than 40 percent.

3. Determination of the amount of suitable habitat necessary to support a pair: The current CEA process requires that each analysis specify the amount of nesting and foraging habitats typically found within home ranges in the particular geographic area. While this requirement has not been modified in Alternative 3, the alternative provides figures that are appropriate to use based on information contained in the CASPO Report. The CASPO Report documents the fact that average acreages of suitable habitat found within owl use areas, varies widely depending upon cover type (and associated prey species). Within the mixed conifer forest type, it is estimated that neighboring owl pairs overlap in their use of habitat by about 22 percent (Verner, personal comm.). The following figures for habitat use include habitat shared between neighboring pairs.

Red Fir: Data collected from the Lassen Study Site (CASPO Report, Chapter 6) indicate that individual birds use an average of about 4,500 acres of suitable habitat in the red fir habitat type. Information on pairs is not available, but data from this and other study sites indicate an overlap of about 48 percent between members of a pair. Using this information, the average acres of suitable habitat used by a pair can be roughly estimated to be about 6,840 acres, of which 3,740 acres is suitable nesting habitat (Zabel, pers. comm., 1992).

Mixed Conifer: Data collected from the Sierra mixed-conifer Study Site indicate that spotted owl pairs used an average of about 2,550 acres of suitable habitat in the mixed conifer forest type. Of this, about 450 acres is typically suitable as nesting habitat (Verner, et.al. 1990).

Oak Woodland: Data collected from the Sierra oak woodland Study Site indicate that spotted owl pairs use an average of 780 acres of suitable habitat in the oak woodland habitats, of which about 140 acres is suitable as nesting habitat (Neal, et. al., 1989).

In addition to changes in the data or assumptions used in the CEA process, the CASPO Report identified the following concerns: (1) the process lacks specific guidance for retaining very large trees, and (2) it lacks specific guidance for retaining snags and maintaining some quantity of dead-and-downed material in specific size classes.

The CEA process ensures that large trees will be retained within, typically, up to 2,500 acres of suitable habitat within an owl's use area. The process ensures that no degradation of this habitat will occur through green timber sales, thus ensuring that large trees will be retained. There is no requirement, however, that any habitat components be retained within habitat that is not determined to be suitable (those timber strata with less than 50 percent canopy closure). The process therefore lacks specific guidance for retention of large trees in several of the timber strata addressed as "Other Strata" in the CASPO Report recommendations (specifically, M2G, M3P, M4P, R3P, R4P, and those "N" strata which are determined to have less than 50 percent canopy closure). The CEA process lacks specific guidance for retention of snags or dead-and-downed material in either suitable or unsuitable habitat.

The I.D. team first considered whether the CASPO Report's concerns regarding retention of large trees, snags, and dead-and-downed material could be addressed by adding guidance for these elements only within suitable habitat (since that is all that the CEA process currently addresses). This would not provide any guidance for retention of these habitat elements in several of the timber strata that the CASPO Report described as "stand types used for nesting by owls but not significantly selected based on availability"

(particularly, the strata designated as "P" stands). It was determined that this would not address the concerns identified in the CASPO Report for the following reasons:

1. The existing amount and distribution of suitable owl habitat is not, in all cases, adequate or desirable for the future. Many owl use areas currently contain fewer acres of suitable habitat than the average amount of habitat found in studies to be utilized by spotted owls. It is unknown in which of these owl sites the amount of habitat is adequately supporting reproducing pairs, and in which it is not. If large trees and snags are not maintained within some of the younger or more open stands that are not currently defined as suitable (i.e. less than 40 percent canopy closure) it will be a very long period of time before these stands can develop important elements such as large, decadent trees and logs. By applying guidance only to suitable habitat, existing patterns of fragmentation and habitat isolation will be maintained or increased and successful dispersal can become an increasing concern.

2. It is much more difficult to assure that future management options will be maintained if harvest results in removing habitat elements that require in excess of 200 years to recreate, versus harvest which results in removing habitat elements that can be replaced in less than 100 years. Since it is not known where Forests may want to manage for spotted owls in the future, it may be just as important to consider long-term effects within potential habitat as in currently suitable stands.

For these reasons, this alternative adds standards for retention of large trees and snags, similar to those contained in the CASPO Alternative, to both Selected and Other Timber Strata within an owl's use area:

1. Retain all snags in Protected Activity Centers. Outside of Protected Activity Centers, retain the largest snags $\geq$ 30 inches in dbh, to a maximum of 8 snags per acre, averaged over the cut unit or stand. Where this guideline results in less than 20 square feet basal area of snags per acre, retain the largest remaining snags to achieve 20 square feet basal area, or a maximum of 8 snags per acre (whichever is less). Snags less than 15 inches dbh or less than 20 feet tall do not need to be retained.

2. Within defined owl use areas, remove no live tree $\geq$ 30 inches dbh and retain at least 30 percent of the basal (or 50 square feet per acre, whichever is greater) in the largest healthy trees and cull within the following timber strata: M2G, M3P, M3N, M3G, M4P, M4N, M4G, P3N, P3G, P4N, P4G, R3P, R3N, R3G, R4N, R4G. (This would apply only to those acres which the CEA process determines are available for harvest).

3. Beginning with the largest downed log (by volume), sequentially retain pieces of downed wood until an average of at least 10-15 tons per acre are retained. Cull logs created by a timber sale should be left at or near where they fall, and included in the tons per acre total.

Also added to Alternative 3, is the requirement to prevent any significant disturbance within the best 300 acre block of habitat surrounding a nest or roost stand. This requirement is added to ensure that Alternative 3 meets the need identified in the CASPO Report to "protect known owl nest stands (or main roost stands if nest stands are not known) from any significant degradation" (CASPO Report, Chapter 1). Under the current CEA process, there is no assurance that habitat surrounding nest stands will remain undisturbed, particularly if this habitat does not currently meet the definition of suitable. This could result in the harvest of habitat (or future habitat) surrounding nest or roost stands. As a result, it might take considerably longer to develop suitable characteristics and to achieve the goal of providing a stand of at least 300 acres of quality habitat surrounding a nest site.

United States Department of Agriculture | Forest Service | RO

Reply To: 2670 Date: October 28, 1991

Subject: Revised Cumulative Effects Analysis

To: Forest Supervisors: Modoc, Lassen, Plumas, LTBMU, Tahoe, Eldorado, Stanislaus, Sierra, Inyo, and Sequoia National Forests

The Cumulative Effects Analysis (CEA) process is currently being used to evaluate the effects of proposed green timber sales which may affect California spotted owls. After reviewing a number of cumulative effects analyses, we have modified the original version of the analysis process, dated July 24, 1991, to increase its interpretability and to improve the quality of documents received and analysis completed by this office. As the process continues to evolve we will send you additional updates. Forests should continue to complete this process for all activities which may affect habitat for California spotted owls. All timber sales that include green timber will continue to be reviewed by my staff prior to advertisement.

The enclosed document contains my suggested format and content for documents submitted for review. The attached CEA process and format should be used for all documents submitted for initial review after November 1, 1991. To increase the efficiency of the review process, we recommend that you establish a review team to review your documents for consistency prior to submittal to this office. An increase in quality control at the Forest level will decrease the time required for review by this office. When scheduling meeting dates with my staff, we recommend that you allow at least three hours of my staff's review time per document submitted. Consider this preview time when scheduling a meeting time and date to avoid unnecessary delays in the review process. This will allow my staff sufficient time to analyze maps and documents and to coordinate a response.

Some confusion still exists as to when sales can be advertised after completing this process. First, this office must review your cumulative effects analysis for all timber sales which remove green timber through competitive bidding and award of a timber sale contract. Upon receipt of a letter accepting your cumulative effects analysis as adequate, you may modify the appropriate environmental documents, including decision notices if needed. Then, the sale may be advertised.

In addition, some questions also exist on how to proceed in the absence of suitable owl habitat, particularly with projects located in habitats representative of east-side conditions. Forests must submit documentation of

their cumulative effects analysis for review by this office even if suitable habitat is lacking in the analysis area.

We appreciate the enormous effort your staffs have made in working on this challenging issue and ask for their continued patience as we continue to refine this process.

If you have questions about this letter or the analysis process, please contact Chris Jauhola, FWL Director, at (415) 705-2884 or Ed Whitmore, TM Director, at (415) 705-2648.

/S/ BEVERLY HOLMES

RONALD E. STEWART
Regional Forester

Enclosures

Jack Gipsman, OGC-SF
Angeles NF
Cleveland NF
Los Padres NF
San Bernardino NF
Deputy Chief, NFS
Wilderness Society
Natural Resources Defense Council
California Forestry Association
Western Forest Industries Association
Small Business Forest Producers Association
C.Jauhola:smr-9/16/91 - FWL Director/Owl Direction/CEA Process-CA Owl -LTR

ENCLOSURE 1:

OVERVIEW OF ANALYSIS PROCESS

The following narrative provides you with an overview of analyses needed to prepare the cumulative effects document.

ANALYSIS PROCESS

A. Determine Analysis Area.

1. Map all proposed harvest units in the project area.

2. Analyze all owl locations then determine and map activity centers in the vicinity of the project area.

DEFINITION: Activity center = the most recent and best location for an owl, based on owl status (i.e. reproductive pair, pair, or resident single), year, time of day (night vs. day), and season (breeding vs. nonbreeding).

a. Map all known owl activity centers for pairs or resident singles in the vicinity of the project area.

DEFINITION: Known owl = an observed or detected pair or resident single owl (three or more responses of single owl in same general area within one or more breeding seasons). Sightings must be within 0.5 square mile of each other (i.e. an activity center) if the nest site cannot be determined.

b. Map all activity centers for predicted owls. The prediction of owls is based on the quantity of available suitable habitat, not owl sightings. Specify in the write-up the amount of nesting and foraging habitats typically found within home ranges of owls for your geographic area. Cite sources of local research which take into account overlap of home ranges during breeding seasons between adjacent pairs, not average home range size. Document your sources in the write-up. Attempt to centrally locate activity centers of predicted owls within available suitable habitat; sighting information or habitat availability may not make this possible.

DEFINITION: Predicted owl = in the absence of data to confirm a known owl, an owl assumed to occupy an area, based on the availability of a sufficient amount of suitable habitat beyond the needs of known adjacent owls.

3. Locate and map owl use areas for known owls, then map use areas for predicted owls.

To delineate an owl use area, determine the amount of suitable nesting and foraging habitats available for each known or predicted owl within an area of approximately 3,500 acres, then describe a polygon defined by half the distance to all adjacent owl activity centers, or approximated by a 1.3 to 1.5 mile radius. Owl use areas are not

normally circles. They should be drawn to follow natural topographic features (where these features are likely to be barriers to movement) or to distribution of suitable habitat. For an example, owls may be using a long, narrow drainage (longer than 2.6 miles long but less than 2.6 miles wide) as a result of steep ridges separating adjacent drainages. Specify in the write-up any deviations from the above methodology.

DEFINITION: Owl use area = an irregularly shaped polygon which contains a known or predicted activity center and encompasses the amount of nesting and foraging habitats typically found within home ranges during the breeding season for your geographic area.

a. Determine locations of owl use areas for all known owls (pairs or resident singles) or predicted owls directly affected by the proposed project.

DEFINITION: Directly affected owl = any known owl (pair or resident single) or predicted owl whose owl use area overlaps any proposed project site (e.g. timber sale unit, fuel break, road construction) whether or not the activity occurs in suitable habitat.

b. Determine locations of owl use areas for all known owls (pair or resident single) or predicted owls indirectly affected by the proposed project.

DEFINITION: Indirectly affected owl = any known owl (pair or resident single) or predicted owl whose owl use area does not overlap a proposed project site and whose home range during the breeding season is expected to overlap with that of a directly affected owl.

4. Define the analysis area.

a. Draw a line at least 1.3 mile radius around the project area and the boundaries of all directly and indirectly affected owl use areas. If the Forest constrains the analysis area on one or more sides because of topographic barriers or areas with unsuitable vegetative types (e.g. large sagebrush or grassland flats) indicate these features on the analysis area map and include a description in the write-up of why the area was constrained.

b. If there are blocks of suitable habitat within the analysis area that are not included in any owl use area, check to see whether there is sufficient habitat available to predict another pair. If not, explain the apparent "non-use" of this habitat in your write-up. It may be necessary to expand the analysis area to make a reasonable attempt to predict an owl pair.

c. Include other ownerships within the analysis area (such as private, state or other federal ownerships) whether suitable habitat exists or not. Analysis area boundaries should <u>not</u> follow legal subdivisions or ownership boundaries. Instead, the boundary of the analysis area should follow natural topographic features or vegetative types, based on your best estimate of owl use areas. Quantify the amount of suitable habitat by ownership within the analysis area and the total size of the analysis area in the write-up (see enclosure 2 for a suggested format).

DEFINITION: Analysis area = an irregularly shaped polygon which encompasses the entire proposed project and all directly or indirectly affected, known or predicted owl use areas within at least a 1.3 mile radius from the project area.

5. The above may result in subdividing Forest Plan management areas or timber compartment inventories or information.

B. Suitable Owl Habitat

1. Map existing suitable nesting and foraging habitat within the analysis area (See step A for the analysis area description).

When mapping existing suitable habitat do not focus on one component, such as canopy closure. Instead consider all attributes in total, including the presence of dominant overstory trees, multi-storied canopy structure, decadence (both standing and dead), and hardwoods, if applicable. Document any variation from these definitions in the write-up.

a. West-side habitat

Nesting habitat: greater than 70% crown closure, over half of which is in dominant, overstory trees (size of dominant trees will vary from typical west-side conifer habitat to east-side habitat and atypical habitat such as oak woodland types);

Foraging habitat: 50% or greater crown closure (includes both overstory and understory trees if greater than 20-30 feet tall);

The following description of suitable habitat characteristics applies to both nesting and foraging habitat:

The spotted owl's home range needs a variety of cover types, with half of the canopy made up of dominant, overstory trees and the rest made up of trees 30 feet or taller (including hardwoods). Preference is shown for stands with two or more layers, but open enough to allow for observation and flying space to attack prey. Large trees with sufficient branching for perches and nest sites are preferable. Substantial amounts of dead woody debris, both standing and dead, are desirable.

b. East-side habitat

Potential suitable east-side habitat, particularly for the Modoc and Inyo National Forests, includes any stand with larger overstory trees and some type of understory (either conifer or hardwood) with a combined canopy closure greater than 50 percent. Pure east-side pine stands with no understory (pine or other) do not typically provide suitable habitat conditions.

2. Identify methods used to determine the amount and suitability of owl habitat (e.g. aerial photos, ground verification, timber stand inventory, landsat imagery, LMP database, etc.) in the write-up.

Note: use the most current habitat information available. This may mean updating compartment or LMP data bases.

3. Map "atypical" habitat where documented owl nesting has occurred outside of habitat considered suitable, as defined above, within the analysis area. An example may be a nest location in oak woodlands in a particular owl use area, or spotted owl reproduction in young, poorly-stocked conifer stands with a significant hardwood component. Again, this atypical habitat may only be counted as suitable nesting habitat only for that nesting owl pair and that owl use area. Do not assume that all similar habitat, without verified occurrence of nesting, is suitable nesting habitat for any other owl use areas or for the entire analysis area.

   When nesting in atypical habitat was not documented, only radio-telemetry data will be used to justify inclusion of any atypical foraging habitat into acreage totals of suitable habitat; cite your sources in the write-up. Again, such data would only apply to that individual owl use area.

   DEFINITION: Atypical habitat = habitat which does not meet the above definition of suitable habitat, but the habitat is included in acreage totals of suitable nesting habitat (based on documented nest locations or reproduction) or foraging habitat (based on radio-telemetry data) for an individual owl use area.

ENCLOSURE 2:

RECOMMENDED CONTENT AND FORMAT OF CUMULATIVE EFFECTS ANALYSIS REPORT

To expedite the review process, the following narrative provides a recommended format and content for your cumulative effects analysis report. For ease in presenting information, several tables are included for your use. Not all of the following information may apply to your project. You may need to include additional information to adequately describe the cumulative effects of your proposed project(s). If additional tables of data are included, designate each table with a number and cite all tables in text. The cumulative effects report and associated maps should reflect a high degree of professionalism suitable for viewing by external audiences.

A. Heading

1. The heading of the document should include the following:

   a. Project name

   b. Forest and Ranger District

   c. Author

   d. Reviewer

   e. Dates prepared and reviewed by Forest

B. Introduction

1. Purpose of this analysis is to review proposed, interrelated and interdependent, and foreseeable actions to determine cumulative effects on the California spotted owl.

C. Existing environment

1. Species account

   a. Describe known biological information associated with the occurrence of spotted owls in the analysis area, including relevant information from adjacent ownerships.

      1). Include data on status (e.g. reproductive pair, pair, resident single, status unknown) and history (e.g. reproductive pair since 1989; pair in 1990, then reproductive pair in 1991). Provide a general summary (e.g. the analysis area contains three owls use areas: two reproductive pairs and a resident single which have occupied the area since 1989). Then, provide the specifics for each owl use area and refer to Table 3.

b. Discuss survey results

1). Discuss information relevant to survey protocols.

a). Which survey methods were used (e.g. March 12, 1991 or earlier versions of protocol; research protocol used by Humboldt State University) and the year these methods were used.

b). The number of completed visits by year of survey.

c). Approximate proportion of individual owl use areas and analysis area covered by surveys following established protocol.

d). Document any deviations from protocol; for example, surveys were conducted after Aug. 31 to complete a visit.

2). If established protocols were not used, document why and identify the level of effort (e.g. area of coverage, number and timing of completed surveys) and confidence in your results.

c. Discuss owl use areas in light of known or predicted owls.

2. Habitat account

a. Define suitable nesting and foraging habitat for your geographic area, including a consideration of all structural elements such as multi-storied stands, presence of dominant trees, decadence (standing and dead), etc.

1). Identify methods used to determine the amount and suitability of owl habitat (i.e. aerial photos, ground verification, timber stand inventory, landsat imagery, LMP database, etc.). Discuss the following relevant items:

a). When data sources were last updated or revised

b). How much (acres and percentage) of the area was ground checked

c). Which specific attributes (e.g. canopy closure, multi-storied stand structure, decadence) of suitable habitat were verified. In addition, how (e.g. occular estimate, vegetation sampling in plots) and where (e.g. timber sale units, proposed road line, owl use area, or entire analysis area) the attributes were checked.

d). Identify the timber strata you considered as atypical suitable nesting and foraging habitats; distinguish between the habitat designations. Cite any sources used to justify habitats designated as "atypical".

2). Document any deviation from definitions of suitable habitat shown in enclosure 1 and explain why. If atypical habitat is identified for an owl use area, discuss stand conditions

and year(s) of reproduction by owls and cite any research or sources supporting your determination of atypical habitat.

3). Discuss whether you consider the habitat as representative of west- or east-side conditions.

b Specify the amount of nesting and foraging habitats typically found within home ranges for your geographic area. Cite sources of local research which takes into account overlap of home ranges during the breeding season between adjacent pairs, not average home range size.

c. Describe the quantity and quality of all suitable habitat within owl use areas (cite Table 3 where appropriate). Do not double-count nesting habitat as foraging habitat; keep the acreage totals distinct for each habitat type. Also do not double-count acres of habitat for overlapping home ranges of owls (i.e. assign suitable habitat acres to only one use area).

1). Document why any deviations from the suggested methodology (see Enclosure 1) for establishing boundaries of owl use areas or analysis area exist.

2). Quantify the total size (acres) of the analysis area.

d. If suitable habitat is not incorporated into an owl use area or into the analysis area, discuss factors which may affect habitat use by owls.

1). Barriers to accessibility of suitable habitat (e.g. large burns or lava fields, location of other owl use areas, distances between habitat patches of suitable habitat).

2). Degree of fragmentation and its effects on the suitability of habitat for foraging, roosting, and nesting (e.g. patch size).

3). Effects of fragmentation or barriers to accessibility of suitable habitat in relation to dispersal of owls, based on the quantity and quality of suitable dispersal corridors in the area.

4). Discuss the potential of habitat within harvest units either retaining or achieving desired habitat characteristics with or without proposed silvicultural prescriptions.

D. Description of proposed project

1. Describe the action (cite Tables 1 and 2 where appropriate)

a. Type of project (e.g. commercial thinning with no removal of suitable habitat)

b. Scope of project (i.e. original and revised volume (MMBF) and acres)

c. Location of project

d. Month and date proposed for advertisement

e. Silvicultural prescriptions (e.g. clearcut, thinning)

f. Logging systems (e.g. cable system, tractor)

g. Road construction or reconstruction

2. Include the following tables as a part of the discussion. Enter and explain codes for silvicultural prescriptions (e.g. CC = clearcut, TH = thinning). Suitable and atypical habitat acres are combined in each of the tables.

****

Table 1. Number, size, and silvicultural prescriptions for sale units in the (name project), including pre- and post-harvest comparison of suitable California spotted owl habitat.

			Suitable habitat (acres)			
				Post-project		
Unit	Total acres	Silvicultural prescription	Pre-project	Degraded	Removed	Total
Total:						

Note: "Degraded" is defined as a reduction in the quality of habitat from the existing condition, but the habitat category is unchanged after manipulation (i.e. nesting habitat is still nesting habitat after logging). "Removed" is defined as a complete loss or degradation of habitat to a point where it is no longer considered suitable.

Table 2. Total miles and acres of road construction/reconstruction resulting from implementation of the (name project), including effects on suitable California spotted owl habitat.

			Suitable habitat (acres)			
			Removed		Degraded	
Activity	Miles	Total acres	Nesting	Foraging	Nesting	Foraging
Construction						
Reconstruction						
Total:						

Note: "Degraded" is defined as a reduction in the quality of habitat from the existing condition, but the habitat category is unchanged after manipulation (i.e. nesting habitat is still nesting habitat after logging). "Removed" is defined as a complete loss or degradation of habitat to a point where it is no longer considered suitable.

******

E. Effects of proposed action

Evaluate all effects relative to the California spotted owl and its habitat, including direct effects, indirect effects, and reasonably foreseeable future actions.

1. Direct effects (i.e. harvest related).

   a. Describe how the project, including any proposed sale construction and/or reconstruction, would directly affect the quantity and quality of suitable and atypical habitat. Consider all affected components (e.g. decadence, multi-storied structure, canopy closure, large dominant overstory trees) of suitable habitat.

      1). Quantify the amount of suitable habitat remaining <u>after</u> completion of the proposed project for <u>each</u> **known or predicted owl** pair or resident single, **whether directly or indirectly affected.** Combine the effects of harvest units (Table 1) and roads (Table 2). Combine suitable and atypical habitat in Tables 1 and 2; however, provide a narrative that discusses the relative contribution of atypical habitat to the total amount of habitat shown in Table 3. Discuss the amount of suitable nesting habitat degraded to a point where it is only suitable foraging habitat after logging or manipulation. If more than one mitigation alternative is proposed, include pre- and post-harvest estimates for each.

      DEFINITION: Direct effects = effects caused by the action.

2. Indirect effects (i.e. harvest related but delayed)

   a. Include a discussion of indirect effects which are related to the project but may occur at a later time and may affect suitable or

atypical habitat (e.g. prescribed burning would remove habitat during site preparation after sale, etc.).

DEFINITION: Indirect effects = effects caused by the action that are later in time and are reasonably certain to occur.

3. Reasonably foreseeable effects

   a. Include a discussion on effects of other actions which are reasonably foreseeable up to at least five years. If a five year time frame is not considered, specify the time frame you have considered. Examples of reasonably foreseeable actions could include advertised or sold sales, other projects with signed decision notice (roads, campground developments, etc.), approved timber harvest plans, or predictable actions on private lands which remove suitable habitat. Make a reasonable prediction of actions which may affect suitable habitat on private lands, based on past management history. Include an explanation of these reasonably foreseeable actions and quantify (i.e. acres of habitat removed) the effect on suitable owl habitat in Table 3.

4. To summarize all of the above effects, include the following table for each mitigation alternative you propose. Include only data for habitat removed, not degraded.

******

Table 3. Summary of effects (including reasonably foreseeable effects) of proposed action from the (enter name of your project) on habitat of the California spotted owl, by owl use area. NFS = National Forest System lands.

Owl use area: _____

Owl status:

Current status of known owl? (check one):
Reproductive pair ____ Pair ____ Resident single ____
Predicted owl? (check one): Yes ____ No ____
Directly affected owl? (check one): Yes ____ No ____
Indirectly affected owl? (check one): Yes ____ No ____

Habitat status:

		Pre-project			Post-project		
	Total	Suitable habitat (acres)			Suitable habitat (acres)		
Ownership	area	Nesting	Foraging	Total	Nesting	Foraging	Total
NFS							
Private							
Other (specify)							
Total:							

*****

F. Mitigation

1. For owl use areas where suitable habitat is reduced below levels needed for each known or predicted pair:

   a. Determine whether owl use areas can be shifted in order to include sufficient suitable habitat for <u>all</u> owls, including predicted pairs, within the analysis area (make sure the original activity center is within the new use area and located at least .25 mile from the new use area boundary), or

   b. Where "a" does not provide sufficient suitable habitat for each owl use area, propose modifications to the sale which will have the least impact on the timber sale program but will still meet the needs of owls and other resources. Examples include shifting units to harvest currently unsuitable habitat, substituting additional salvage for some of the green volume, changing prescriptions to retain suitable habitat characteristics after harvest, etc.

      1). If modifications to owl use areas, the analysis area, or timber sale units were required to avoid adverse effects to California spotted owls, discuss and summarize efforts (1) to shift owl use and analysis areas, and (2) attempts to locate replacement volume within the sale area or changes in silvicultural prescriptions.

G. Summary

1. Summarize the results of your analysis, including a discussion on the effects to owls or their habitat and the required mitigation to avoid adverse cumulative effects.

   For example, the original project proposes to remove 350 acres of mature or older timber to produce a volume of 6 MMBF (million board feet). As a result 30 acres of suitable California spotted owl habitat would be removed or degraded within two known owl use areas containing a total of one reproductive owl pair and one resident single. The residual amount of suitable habitat remaining in owl use area XYZ is less than needed to support an owl pair. To avoid adverse cumulative effects, the Forest proposes to drop unit 3 and modify the prescription in unit 6 to retain suitable owl habitat. The revised sale area now proposes to harvest 330 acres for a total volume of 5.6 MMBF. As a result of this modification and other mitigation requirements such as a limited operating season, the proposed project would have no cumulative effect on the California spotted owl.

H. Appendices

1. Topographic maps of project area or sale area to serve as a paper base. Include the Forest, District, and timber sale name on each map or map overlay. Identify the preparer and date prepared on all maps and mylar overlays.

a. Mylar overlay of all existing suitable habitat. Distinguish between suitable and atypical habitats and between nesting and foraging habitats.

b. Mylar overlay(s) for all owl data:

1). Survey data

a). Spatial location of nest and roost sites, activity centers, owl locations.

c. Mylar overlay for all proposed timber sale units, road construction, reconstruction, and other actions affecting habitat.

d. Mylar overlay showing boundaries of individual owl use areas and analysis area.

e. Legal locations on all base maps and overlays.

f. Reference marks to align overlays with base maps.

g. Clear and distinguishable symbols, patterns, and legends which may reproduce during xeroxing.

2. References used and personal communications.

ENCLOSURE 3:

APPROVAL OF
CUMULATIVE EFFECTS ANALYSIS PROCESS

The following narrative describes the approval process for cumulative effects analysis reports.

1. Forest Supervisor will review all competitively awarded timber sales that remove green trees on the Forest, including Ranger sales and sales not in suitable owl habitat. The Forest will document their cumulative effects analysis (see enclosures 1 and 2) and transmit them to the Regional Forester with recommendations for any proposed modifications.

    a. Include completed cumulative effects analysis, legible coded maps (displaying suitable habitat, owl activity centers, owl use areas, proposed sale units, etc.) with clear keys, and modified BE. Include a photocopy of the analysis map suitable for xeroxing.

2. Regional Forester will review Forest Supervisor recommendations and transmit a letter to the Forest when the cumulative effects analysis is determined to be adequate.

3. Forest Supervisor, based on the Regional Forester's review, will modify the FONSI and environmental documents and, if appropriate, the Decision Notice. The Supervisor may then advertise the sale.

APPENDIX B

Selected and Other Strata Acreages

National Forest	Selected	Other
Eldorado	55000	281000
Lassen	106000	428000
Plumas	241000 1/	480000
Sequoia	43000	252000
Sierra	154000	142000
Stanislaus	25000	183000
Tahoe	71000	421000

1/ Includes eastside Mixed Conifer using same strata convention as for Mixed Conifer

Acres rounded to nearest thousand

APPENDIX B

Distribution of California Spotted Owl nest habitat types compared with proportions of available habitats in the Sierra Nevada.

95 percent Bonferroni interval

Habitat type 1/	Sample size	Lower	Upper	Available	Result
M2G 2/	2	-0.0120	0.0390	0.0209	U = A 3/
M3P	10	0.0121	0.1231	0.2369	U < A
M3N,G	44	0.1962	0.3984	0.2501	U = A
M4P	10	0.0121	0.1231	0.1418	U < A
M4N,G	67	0.3426	0.5628	0.2005	U > A
R3P	2	-0.0120	0.0390	0.0448	U < A
R3N,G	3	-0.0109	0.0514	0.0522	U < A
R4N,G	10	0.0121	0.1231	0.0464	U = A
Total	148				

1/ Refer to figure 5B CASPO Report for distribution of habitat types that were significantly different (X^2 = 79.9, df = 7, $P < 0.05$) between used and available types.

2/ Habitat codes correspond to FS timber strata labels: M = mixed-conifer, R = red fir; 2 = pole-sized trees (<12 inches in dbh), 3 = small sawtimber (trees 12-24 inches in dbh); G = 70+ percent canopy cover, N = 40-69 percent canopy cover; P = 0-39 percent canopy cover.

3/ U = A; used equal to expected by chance (available).
U < A; used less than expected.
U > A; used greater than expected.

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS SYSTEM
Database Version: 08/08/89

09/09/92
PAGE: 1

California Wildland Habitat Database
List of Wildlife Species Found within the Sierran Province
of the California Spotted Owl

ID	NAME		1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6	STAGE		SEASON IN LOCATION									
			FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
A003	LONG TOED SALAMANDER	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y			Y	Y	Y			Y	Y
A003	LONG TOED SALAMANDER	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y			Y	Y	Y			Y	Y
A003	LONG TOED SALAMANDER	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y			Y	Y	Y			Y	Y
A006	ROUGH-SKINNED NEWT	MCN		LLL	MMM	MMM	HHH	LLL	MMM	HHH	HHH	LLL	MMM	HHH	HHH	LLL	MMM	HHH	HHH	HHH	Y	Y				Y		Y				
A006	ROUGH-SKINNED NEWT	PPN		LLL	MMM	MMM	LLL	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	HHH	Y	Y				Y		Y				
A007	CALIFORNIA NEWT	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y		Y	Y	Y	Y	Y
A012	ENSATINA	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y	Y	Y	Y	Y	Y	Y
A012	ENSATINA	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y	Y	Y	Y	Y	Y	Y
A014	CALIFORNIA SLENDER SALAMANDER	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y								Y	Y
A016	PACIFIC SLENDER SALAMANDER	MCN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y							Y	Y		
A016	PACIFIC SLENDER SALAMANDER	PPN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y							Y	Y		
A020	BLACK SALAMANDER	PPN				MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM		Y	Y						Y				
A022	ARBOREAL SALAMANDER	MCN						LLL	MMM	MMM		MMM	MMM	MMM		MMM	MMM	MMM			Y	Y	Y							Y	Y	
A023	MOUNT LYELL SALAMANDER	MCN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y	Y	Y				Y	Y	Y	Y	Y
A023	MOUNT LYELL SALAMANDER	RFR	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y	Y	Y				Y	Y	Y	Y	Y
A032	WESTERN TOAD	MCN	L	L	M	M	M	M	L	L	M	M	M	M	M	L	L	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
A032	WESTERN TOAD	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
A032	WESTERN TOAD	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
A039	PACIFIC TREEFROG	MCN	L	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
A039	PACIFIC TREEFROG	PPN	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
A039	PACIFIC TREEFROG	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
A041	SPOTTED FROG	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N					Y					
A041	SPOTTED FROG	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N					Y					
A042	CASCADES FROG	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N				Y		Y				
A042	CASCADES FROG	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N				Y		Y				
A043	FOOTHILL YELLOW-LEGGED FROG	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y			Y		Y	Y	Y	Y	Y
A043	FOOTHILL YELLOW-LEGGED FROG	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y			Y		Y	Y	Y	Y	Y
A044	MOUNTAIN YELLOW-LEGGED FROG	PPN	L	L	L	L	L	L		M	M	M	M	M	M		M	M	M	M	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
A045	NORTHERN LEOPARD FROG	MCN		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y			Y	Y				
A045	NORTHERN LEOPARD FROG	PPN		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y			Y	Y				
A046	BULLFROG	MCN			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y
A046	BULLFROG	PPN			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y
B051	GREAT BLUE HERON	MCN											LL	LL	LL	LL	MM	MM	MM	MM	N	Y	Y	W		Y	Y	Y	Y	Y	Y	Y
B051	GREAT BLUE HERON	PPN											LL	LL	MM	MM	HH	HH	HH	HH	Y	Y	Y	W		Y	Y	Y	Y	Y	Y	Y
B058	GREEN-BACKED HERON	MCN							LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	N	N	S			S		S	S	S	S	S
B058	GREEN-BACKED HERON	PPN							LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	N	N	S			S		S	S	S	S	S

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B076	WOOD DUCK	MCN											L	L	L	L	L	L	LLL	LLL	LLL	LLL	N	N	Y			Y	S	S	Y	Y	Y	Y
B076	WOOD DUCK	PPN											L	L	L	L	L	L	LLL	LLL	LLL	LLL	N	N	Y			Y	S	S	Y	Y	Y	Y
B076	WOOD DUCK	RFR											L	L	L	L	L	L	LLL	LLL	LLL	LLL	N	N	Y			Y	S	S	Y	Y	Y	Y
B103	BUFFLEHEAD	RFR										LL	LL			LL	LL						N	N	W	W		Y	Y	Y	W	W	W	W
B108	TURKEY VULTURE	MCN	HHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	MHH	Y	Y	Y	S		Y	S	S	Y	Y	Y	Y
B108	TURKEY VULTURE	PPN	HHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	MHH	Y	Y	Y	S		Y	S	S	Y	Y	Y	Y
B108	TURKEY VULTURE	RFR	HHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	MHH	Y	Y	Y	S		Y	S	S	Y	Y	Y	Y
B109	CALIFORNIA CONDOR	MCN	MHH	MHH	MHH	LHH		MHH	MHH	LHH		MHH	MHH	LHH		MHH	MHH	MHH	HH	MHH	Y	Y							Y			
B109	CALIFORNIA CONDOR	PPN	MHH	MHH	MHH	LHH		MHH	MHH	LHH		MHH	MHH	LHH		MHH	MHH	LHH	HH	MHH	Y	Y							Y			
B109	CALIFORNIA CONDOR	RFR	MHH	MHH	MHH	LHH		MHH	MHH	LHH		MHH	MHH	LHH		HHH	HHH	MHH	HH	MHH	Y	Y							Y			
B110	OSPREY	MCN	L	L	L	L	L	L	L	LMM	LMM	LMM	LMM	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	Y	Y	S	S		S	S	S	S	S	S	S
B110	OSPREY	PPN	L	L	L	L	L	L	L	LMM	LMM	LMM	LMM	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	Y	Y	S	S		S	S	S	S	S	S	S
B110	OSPREY	RFR	L	L	L	L	L	LLL	LLL	LLL	LLL	MMM	MMM	MMM	MMM	MHH	MHH	MHH	MHH	MHH	Y	Y	S	S		S	S	S	S	S	S	S	S
B113	BALD EAGLE	MCN	M	M	M	M	M	M	M	M	M	M	L	M	L	M	L	M	L	HHH	HHH	HHH	MHH	MHH	Y	Y	Y	W		Y	Y	Y	W	W	W	Y
B113	BALD EAGLE	PPN	M	M	M	M	M	M	L	M	L	M	L	M		M	M	M	M	M	M	MHH	MHH	MHH	MMH	MHH	Y	Y	Y	W		Y	Y	Y	W	W	W	Y
B113	BALD EAGLE	RFR	L	L	L	L	L	L		L		L		L		L	L	L	L	L		LLL	LLL	LLL	LLL	MHH	N	N	Y	W		Y	Y	Y	W	W	W	Y
B114	NORTHERN HARRIER	MCN	L	L	L																						N	N	W	Y		Y	Y	Y	W	W	W	W
B114	NORTHERN HARRIER	PPN	L	L	L			L																			N	N	W	Y		Y	Y	Y	W	W	W	W
B114	NORTHERN HARRIER	RFR	L	L	L			L																			N	N	W	Y		Y	Y	Y	W	W	W	W
B115	SHARP-SHINNED HAWK	MCN	H	H	M	H	M	H	M	H	H	H	H	HH	HH	H	H	H	HH	HH	H	H	H	H	HH	HH	HM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B115	SHARP-SHINNED HAWK	PPN	H	H	M	H	M	H	M	H	H	H	H	HH	HH	H	H	H	HH	HH	H	H	H	H	HH	HH	HM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B115	SHARP-SHINNED HAWK	RFR	M	M		M		M		M	L	ML	ML	M	L	M	L	ML	ML	M	L	M	L	ML	ML	HM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B116	COOPER'S HAWK	MCN	M	M	L	M	L	M	L	M	L	M	L	MM	MM	M	M	M	M	MM	MM	M	M	M	M	MM	MM	MM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B116	COOPER'S HAWK	PPN	M	M	L	M	L	M	L	M	L	M	L	MM	MM	M	M	M	M	MM	MM	M	M	M	M	MM	MM	MM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B116	COOPER'S HAWK	RFR	M	M	L	M	L	M	L	M	L	M	L	M	M	M	M	M	M	ML	ML	M	M	M	M	ML	ML	MM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B117	NORTHERN GOSHAWK	MCN		M		M		M		M	L	ML	ML	M	M	M	M	HH	HH	H	H	H	H	HH	HH	HH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B117	NORTHERN GOSHAWK	PPN		M		M		M		M	L	M	L	ML	ML	M	M	M	M	HH	HH	H	H	H	H	HH	HH	HH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B117	NORTHERN GOSHAWK	RFR	L	L		L		L		L	L	ML	ML	M	L	M	L	MM	MM	M	M	M	M	HH	HH	HH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B121	SWAINSON'S HAWK	PPN	L	L		L				L	L	L	L			L	L	L	L			LLL	LLL				N	N		S		S	S	S		S		S
B123	RED-TAILED HAWK	MCN	H	HL	L	HL	L	ML	L	HM	M	HM	M	MM	M	MH	H	HH	H	HH	H	HH	H	HH	HH	HH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B123	RED-TAILED HAWK	PPN	H	HL	L	HL	L	ML	L	HM	M	HM	M	MM	M	MH	H	HH	H	HH	H	HH	H	HH	HH	HH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B123	RED-TAILED HAWK	RFR	H	HL	L	HL	L	ML	L	HM	M	HM	M	MM	M	MH	H	HH	H	HH	H	HH	H	HH	HH	HH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B126	GOLDEN EAGLE	MCN	HHH	HHH	HHH	MHH	MHH	HHH	HHH	MHH	MHH	HHH	HHH	MHH	MHH	HHH	HHH	MHH	MHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
B126	GOLDEN EAGLE	PPN	HHH	HHH	HHH	MHH	MHH	HHH	HHH	MHH	MHH	HHH	HHH	MHH	MHH	HHH	HHH	MHH	MHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
B126	GOLDEN EAGLE	RFR	LHH	LHH	LHH	LHH	LHH	LHH	LHH	MHH	MHH	LHH	LHH	MHH	MHH	LHH	LHH	MHH	MHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
B127	AMERICAN KESTREL	MCN	H	H	L	H	L	M	L	M	L	H	M	H	M	M	M	M	M	HMM	HMM	MMM	MMM	HHH	HHH	MHH	MHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS SYSTEM
Database Version: 08/08/89
Ad Hoc Query by Donald Yasuda, Eldorado NF, Pacific RD

09/09/92
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ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B127	AMERICAN KESTREL	PPN	H	H L	H L	M L	M L	H M	H M	M M	M M	HMM	HMM	MMM	MMM	HHH	HHH	MHH	MHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B127	AMERICAN KESTREL	RFR	M	M L	M L	L L	L L	M L	M L	L L	L L	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B128	MERLIN	MCN	M	M	M	M		M M	M M	L L		M M	M M	L L		M M	M M	L L			Y	Y	W	W		W	W	W	W	W	W	W
B128	MERLIN	PPN	M	M	M	M		M M	M M	L L	L L	M M	M M	L L	L L	M M	M M	L L			Y	N	W	W		W	W	W	W	W	W	W
B129	PEREGRINE FALCON	MCN	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	Y	Y	Y	Y		Y	Y	Y	W	Y	Y	Y
B129	PEREGRINE FALCON	PPN	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	Y	Y	Y	Y		Y	Y	Y	W	Y	Y	Y
B129	PEREGRINE FALCON	RFR	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH	Y	Y	Y	Y		Y	Y	Y	W	Y	Y	Y
B131	PRAIRIE FALCON	MCN	HHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	MHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B131	PRAIRIE FALCON	PPN	HHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	MHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B131	PRAIRIE FALCON	RFR	HHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	HHH	MHH	LHH	LHH	MHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B134	BLUE GROUSE	MCN	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B134	BLUE GROUSE	PPN	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	HHH	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B134	BLUE GROUSE	RFR	MLL	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B138	TURKEY	MCN	MLL	MMM	MMM	MLL	MLL	MMM	MMM	MLL	MLL	MMM	MMM	MLL	MLL	MMM	MMM	MLL	MLM	MLM	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
B138	TURKEY	PPN	MMM	HHH	HHH	MMM	LLL	HHH	HHH	MMM	MLM	HHH	HHH	MMM	MLH	HHH	HHH	MMM	MLH	MLM	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
B140	CALIFORNIA QUAIL	MCN	MLM	MMM	MMM	MMM	MLM	MMM	MMM	MMM	MLM	MMM	MMM	MMM	MLM	MMM	MMM	MMM	MLM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B140	CALIFORNIA QUAIL	PPN	MLM	MMM	MMM	MMM	MLM	MMM	MMM	MMM	MLM	MMM	MMM	MMM	MLM	MMM	MMM	MMM	MLM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B141	MOUNTAIN QUAIL	MCN	HMM	HHH	HHH	MMH	MMH	HHH	HHH	MMH	MMH	HHH	HHH	MMH	MMH	HHH	HHH	MMH	MMH	MMH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B141	MOUNTAIN QUAIL	PPN	HMM	HHH	HHH	MMH	MMH	HHH	HHH	MMH	MMH	HHH	HHH	MMH	MMH	HHH	HHH	MMH	MMH	MMH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B141	MOUNTAIN QUAIL	RFR	MLL	MMM	MMM	LLM	LLM	MMM	MMM	LLM	LLM	MMM	MMM	LLM	LLM	MMM	MMM	LLM	LLM	MMH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B251	BAND-TAILED PIGEON	MCN						HLL	HLL	HLL	HLL	HMM	HMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B251	BAND-TAILED PIGEON	PPN						LLL	LLL	LLL	LLL	MMM	MMM	MHH	MHH	MHH	MHH	MHH	MHH	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B251	BAND-TAILED PIGEON	RFR						LLL	LLL	LLL	LLL	L L	L L	L L	L L	L L	LLL	LLL	LLL	HHH	N	N	Y	Y		Y	S	Y	Y	Y	Y	Y
B255	MOURNING DOVE	MCN	M	M	M	M		MLM	MLM	MMM		MMM	MMM	MMM		MMM	MMM	MMM			Y	Y	Y	S		Y	Y	Y	Y	Y	Y	Y
B255	MOURNING DOVE	PPN	H	HLL	HLL	HLL		HMH	HMH	HHH		HHH	HHH	HHH		HHH	HHH	HHH			Y	Y	Y	S		Y	Y	Y	Y	Y	Y	Y
B255	MOURNING DOVE	RFR	L	L	L	L		L L	L L	L L		L L	L L	L L		L L	L L	L L			N	N	Y	S		Y	Y	Y	Y	Y	Y	Y
B262	COMMON BARN OWL	MCN	LHH	LHH				LHH				LHH				LHH					Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B262	COMMON BARN OWL	PPN	HHH	HHH	HHH	LHH		HHH	HHH	LHH		HHH	HHH	LHH		HHH	HHH	LHH			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B263	FLAMMULATED OWL	MCN	H	H L	H L	H L	M L	H H	H H	H H	M M	HHH	HHH	HHH	MMH	HHH	HHH	HHH	MMH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B263	FLAMMULATED OWL	PPN	H	H L	H L	H L	M L	H H	H H	H H	M M	HHH	HHH	HHH	MMH	HHH	HHH	HHH	MMH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B263	FLAMMULATED OWL	RFR	H	H L	H L	H L	M L	H H	H H	H H	M M	HHH	HHH	HHH	MMH	HHH	HHH	HHH	MMH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B264	WESTERN SCREECH OWL	MCN	M	M	M	M	L	M L	M L	M L	L L	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	MLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B264	WESTERN SCREECH OWL	PPN	M	M	M	M L	M M	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	MLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B264	WESTERN SCREECH OWL	RFR	M	M M	M M	M M	L L	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B265	GREAT HORNED OWL	MCN	H	H	H	H	M	H H	H H	H H	H H	HHH	HHH	HHH	MMM	HHH	HHH	HHH	LMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B265	GREAT HORNED OWL	PPN	H	H	H	H	H	H H	H H	H H	H H	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

ID	NAME		1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6	STAGE		SEASON IN LOCATION								
			FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B265	GREAT HORNED OWL	RFR	M	M	M	L	L	M L	M L	L L	L L	MLL	MLL	LLL	LLL	MMM	MMM	LMM	LMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B267	NORTHERN PYGMY OWL	MCN	M	H	H	H	M	HLM	HLM	HLM	MLM	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B267	NORTHERN PYGMY OWL	PPN	M	H	H	H	M	HLM	HLM	HLM	MLM	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B269	BURROWING OWL	PPN	LLL	LLL	LLL																N	N	Y	Y		Y	S	Y	Y	Y	Y	Y
B270	SPOTTED OWL	MCN				L	L	L L	L L	L L	L L	L L	L L	M M	M M	MLL	MLL	HHH	HHH	HHH	Y	Y	Y			Y		Y	Y	Y	Y	Y
B270	SPOTTED OWL	PPN				L	L	L L	L L	L L	L L	L L	L L	M M	M M	MLL	MLL	HMH	HHH	HHH	Y	Y	Y			Y		Y	Y	Y	Y	Y
B270	SPOTTED OWL	RFR	L	L	L	L	L	L	L	L	L	L L	L L	MLM	MLM	MLL	MLL	HHH	HHH	HHH	Y	Y	Y			Y		Y	Y	Y	Y	Y
B271	GREAT GRAY OWL	MCN												HLH	HLH			HHH	HHH	HHH	Y	Y					S			Y	Y	
B271	GREAT GRAY OWL	RFR												HLH	HLH			HHH	HHH	HHH	Y	Y					S			Y	Y	
B272	LONG-EARED OWL	MCN	M	M	M	LLL	LLL	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	LMM	Y	Y	S	Y		Y	Y	Y	Y	Y	S	Y
B272	LONG-EARED OWL	PPN	M	M	M	LLL	LLL	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	LMM	Y	Y	S	Y		Y	Y	Y	Y	Y	S	Y
B273	SHORT-EARED OWL	MCN	L	L L	L L	L L			L L	L L			L L	L L		L L	L L				N	N	W	Y		Y	Y	Y	W	Y	W	Y
B273	SHORT-EARED OWL	PPN	L	L L	L L	L L	L L		L L	L L	L L		L L	L L	L L	L L	L L	L L			N	N	W	Y		Y	Y	Y	W	Y	W	Y
B274	NORTHERN SAW-WHET OWL	MCN	H	H	H	H L	H L	H L	H L	H M	H M	HMM	HMM	HHH	HHH	HMM	HMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B274	NORTHERN SAW-WHET OWL	PPN	H	H	H	H L	H L	H L	H L	H M	H M	HMM	HMM	HHH	HHH	HMM	HMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B274	NORTHERN SAW-WHET OWL	RFR	M	M	M	M L	M L	M L	M L	M M	M M	MLM	MLM	MMM	MMM	MLM	MLM	MMM	MMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B276	COMMON NIGHTHAWK	MCN	HHH	HHH	HMH	H	H	HHH	HMH	H	H	HHH	HMH	H	H	HHH	HMH	H	H		Y	Y	S	S		S	S	S	S	S	S	S
B276	COMMON NIGHTHAWK	PPN	HMM	HMM	HLL	H	H	HMM	HLL	H	H	HMM	HLL	H	H	HMM	HLL	H	H		Y	Y	S	S		S	S	S	S	S	S	S
B276	COMMON NIGHTHAWK	RFR	HLL	HLL	H L	H	H	HLL	H L	H	H	HLL	H L	H	H	HLL	H L	H	H		Y	Y	S	S		S	S	S	S	S	S	S
B277	COMMON POORWILL	MCN	LLL	LLL	LLL	L	L	LLL	LLL	L	L	LLL	LLL	L	L	LLL	LLL	L	L		N	N	S	S		S	S	S	S	S	S	S
B277	COMMON POORWILL	PPN	LLL	LLL	LLL	L	L	LLL	LLL	L	L	LLL	LLL	L	L	LLL	LLL	L	L		N	N	S	S		S	S	S	S	S	S	S
B277	COMMON POORWILL	RFR	LLL	LLL	L	L	L	LLL	L	L	L	LLL	L	L	L	LLL	L	L	L		N	N	S	S		S	S	S	S	S	S	S
B279	BLACK SWIFT	MCN	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S		S	S	S		S
B279	BLACK SWIFT	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	HHH	N	N	S	S		S		S	S	S		S
B279	BLACK SWIFT	RFR	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S		S	S	S		S
B281	VAUX'S SWIFT	MCN	M	M	M	M	M	M	M	M	M	M	M	M	M	MLL	MLL	MLL	MLL	MLL	Y	Y	S	S		S	S	S	S	S	S	S
B281	VAUX'S SWIFT	PPN	M	M	M	M	M	M	M	M	M	M	M	M	M	MLL	MLL	MLL	MLL	MLL	Y	Y	S	S		S	S	S	S	S	S	S
B281	VAUX'S SWIFT	RFR	M	M	M	M	M	M	M	M	M	M	M	M	M	MLL	MLL	MLL	MLL	MLL	Y	Y	S	S		S	S	S	S	S	S	S
B282	WHITE-THROATED SWIFT	MCN	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S				S	Y	Y	S	S
B282	WHITE-THROATED SWIFT	PPN	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S				S	Y	Y	S	S
B282	WHITE-THROATED SWIFT	RFR	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	HHH	Y	Y	S	S				S	Y	Y	S	S
B287	ANNA'S HUMMINGBIRD	MCN	L	M M	M M	L L		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y			Y	S	S	Y	Y	Y	Y
B287	ANNA'S HUMMINGBIRD	PPN	M	M M	M M	L L		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y			Y	S	S	Y	Y	Y	Y
B289	CALLIOPE HUMMINGBIRD	MCN	H	HMH	HMH			HHH	HHH			HHH	HHH			HHH	HHH				Y	Y	S	S		S	S	S	S	S	S	S
B289	CALLIOPE HUMMINGBIRD	PPN	M	MMM	MMM			MMM	MMM			MMM	MMM			MMM	MMM				Y	Y	S	S		S	S	S	S	S	S	S
B289	CALLIOPE HUMMINGBIRD	RFR	M	MLM	MLM			MMM	MMM			MMM	MMM			MMM	MMM				Y	N	S	S		S	S	S	S	S	S	S

ID	NAME			1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B290	BROAD-TAILED HUMMINGBIRD	MCN	M	MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL				Y	Y		S						S		
B294	LEWIS' WOODPECKER	MCN	H	H M	H M	M L	L L	H H	H H	M M	L L	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	W	Y
B294	LEWIS' WOODPECKER	PPN	H	H M	H M	M L	L L	H H	H H	M M	L L	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	W	Y
B296	ACORN WOODPECKER	MCN	L	L	L	L	L					LLL	LLL	LLL	L L	LLL	LLL	LLL	L L	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B296	ACORN WOODPECKER	PPN	H	H	H	H	H	HLL	HLL	HLL	HLL	HMM	HMM	HLL	HLL	HMM	HMM	HLL	HLL	HMM	HMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B298	RED-NAPED SAPSUCKER	MCN	H	H	H	H	M	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	HHH	HHH	MMM	MMM	Y	Y		Y			S					
B298	RED-NAPED SAPSUCKER	PPN	L	L	L	L	L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	MMM	N	N		Y			S					
B299	RED-BREASTED SAPSUCKER	MCN	H	H L	H L	H L	M L	H M	H M	H M	L L	HHH	HHH	HMH	MLM	HHH	HHH	HMH	MLM	HMH	HMH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B299	RED-BREASTED SAPSUCKER	PPN	H	H	H	H	M	H M	H M	H M	L L	HLH	HLH	HLH	M M	HMH	HMH	HMH	MLM	HMH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B299	RED-BREASTED SAPSUCKER	RFR	H	H L	H L	H L	M L	H M	H M	H M	L L	HHH	HHH	HMH	MLM	HHH	HHH	HMH	MLM	HMH	HMH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B300	WILLIAMSON'S SAPSUCKER	MCN										H M	H M	H M	M L	HLH	HLH	HLH	M M	HLH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B300	WILLIAMSON'S SAPSUCKER	PPN										H M	H M	H M	M L	H H	H H	H H	M M	HLH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B300	WILLIAMSON'S SAPSUCKER	RFR										H M	H M	H M	M L	HLH	HLH	HLH	M M	HLH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B302	NUTTALL'S WOODPECKER	MCN	L	M	M	M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	Y	Y	Y	Y		Y	Y		Y	Y		Y
B302	NUTTALL'S WOODPECKER	PPN	L	M	M	M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	Y	Y	Y	Y		Y	Y		Y	Y		Y
B303	DOWNY WOODPECKER	MCN	L	M	M	M	L L	MLM	MLM	MLL	L L	MLM	MLM	MLL	L L	MLM	MLM	MLL	L L	MLM	MLM	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
B303	DOWNY WOODPECKER	PPN	L	M	M	M	L L	MLM	MLM	MLL	L L	MLM	MLM	MLL	L L	MLM	MLM	MLL	L L	MLM	MLM	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
B303	DOWNY WOODPECKER	RFR	L	M	M	M	L L	MLM	MLM	MLL	L L	MLM	MLM	MLL	L L	MLM	MLM	MLL	L L	MLM	MLM	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
B304	HAIRY WOODPECKER	MCN		M M	M M	M M	M L	MLM	MLM	MLM	LLL	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B304	HAIRY WOODPECKER	PPN		M L	M L	M L	L L	MMM	MMM	MMM	LLL	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B304	HAIRY WOODPECKER	RFR		M L	M L	M L	L L	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B305	WHITE-HEADED WOODPECKER	MCN		L	L	L	L	MLL	MLL	MLL	LLL	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B305	WHITE-HEADED WOODPECKER	PPN		L	L	L	L	MLL	MLL	MLL	LLL	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B305	WHITE-HEADED WOODPECKER	RFR		L	L	L	L	LLL	LLL	LLL	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B306	BLACK-BACKED WOODPECKER	RFR										MLM	MLM	MLM	M M	MLM	MLM	MLM	M M			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B307	NORTHERN FLICKER	MCN	H	H	H	H	M	HLM	HLM	HLM	MLM	HMM	HMM	HMM	MMM	HHH	HHH	HHH	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B307	NORTHERN FLICKER	PPN	H	H	H	H	M	H M	H M	H M	M M	HMM	HMM	HMM	MMM	HHH	HHH	HHH	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B307	NORTHERN FLICKER	RFR	L	L	L	L	L	L L	L L	L L	L L	LLL	LLL	LLL	L L	LLL	LLL	LLL	L L	LLL	HHH	Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B308	PILEATED WOODPECKER	MCN										LLL	MMM	MMM	MLM	MMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B308	PILEATED WOODPECKER	PPN										LLL	MMM	MMM	MLL	MMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B308	PILEATED WOODPECKER	RFR										LLL	MMM	MMM	LLL	MMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B309	OLIVE-SIDED FLYCATCHER	MCN	H	H	H	H	H	H	H	H L	H L	HLL	HLL	HMM	HMM	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B309	OLIVE-SIDED FLYCATCHER	PPN	M	M	M	L	M	M	M	L	M L	M L	M L	L L	MLM	MLM	MLM	LLM	HHH			Y	Y	S	S		S	S	S	S	S	S	S
B309	OLIVE-SIDED FLYCATCHER	RFR	H	H	H	H	H	H	H L	H L	HLL	HLL	HMM	HMM	HHH	HHH	HHH	HHH	HHH			Y	Y	S	S		S	S	S	S	S	S	S
B311	WESTERN WOOD-PEWEE	MCN	H	H L	H L	H L	H L	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B311	WESTERN WOOD-PEWEE	PPN	H	H L	H L	H L	H L	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B311	WESTERN WOOD-PEWEE	RFR H	H L	H L	H L	H L	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B317	HAMMONDS' FLYCATCHER	MCN												HLM	HMM			HMM	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B317	HAMMONDS' FLYCATCHER	PPN												HLM	HMM			HMM	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B317	HAMMONDS' FLYCATCHER	RFR												HLM	HMM			HMM	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B318	DUSKY FLYCATCHER	MCN H	HHH	HHH	HHH	HMM	HHH	HHH	HMM	HLL	HMM	HMM	HMM	HLL	HMM	HMM	HMM	HMM	HLL		Y	Y	S	S		S	S	S	S	S	S	S
B318	DUSKY FLYCATCHER	PPN H	HHH	HHH	HHH	HMM	HHH	HHH	HMM	HLL	HMM	HMM	HMM	HLL	HMM	HMM	HMM	HLL			Y	Y	S	S		S	S	S	S	S	S	S
B318	DUSKY FLYCATCHER	RFR M	MMM	MMM	MMM	MLL	MMM	MMM	MMM	MLL	MMM	MMM	MMM	MLL	MMM	MMM	MLL	HLL			Y	Y	S	S		S	S	S	S	S	S	S
B320	WESTERN FLYCATCHER	PPN	M	M M	M M	M M	M L	M M	HHH	HHH	MLL	MLM	HHH	HHH	MLL	MLM	HHH	HHH			Y	Y	S			S	S	S	S	S	S	S
B326	ASH-THROATED FLYCATCHER	PPN L	L L	L L	L L		L L	L L	L L		LLL	LLL			LLL	LLL					N	N	S	S		S	S	S	S	S	S	S
B333	WESTERN KINGBIRD	PPN L	L	L			L L	L L			L L	L L			L L	L L					N	N	S	S		S	S	S	S	S	S	S
B338	PURPLE MARTIN	MCN L	L	L			L	L			L L	L L			LLL	LLL	LLL		LLL		N	N	S			S	S	S	S	S	S	S
B338	PURPLE MARTIN	PPN L	L	L			L	L			L L	L L	L L		LLL	LLL	LLL		LLL		N	N	S			S	S	S	S	S	S	S
B339	TREE SWALLOW	PPN M	M	M	M	M	MLL	MLL	MLL	MLL	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM			Y	Y	Y	S		S	S	S	Y	Y	S	Y
B340	VIOLET-GREEN SWALLOW	MCN H	H	H	H	H	HLL	HLL	HLL	HLL	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM			Y	Y	S	S		S	S	S	S	S	S	S
B340	VIOLET-GREEN SWALLOW	PPN H	H	H	H	H	HLL	HLL	HLL	HLL	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM			Y	Y	S	S		S	S	S	S	S	S	S
B341	NORTHERN ROUGH-WINGED SWALLOW	PPN HHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH			Y	Y	S	S		S	S	S	S	S	S	S
B343	CLIFF SWALLOW	PPN HHH	HHH	HHH	HHH	HHH	HHH	HHH			HHH	HHH			HHH	HHH					Y	Y	S	S		S	S	S	S	S	S	S
B344	BARN SWALLOW	MCN LHH	LHH	LHH			LHH	LHH			LHH	LHH			LHH	LHH					Y	Y	S	S		S	S	S	S	S	S	S
B344	BARN SWALLOW	PPN HHH	HHH	HHH			HHH	HHH			HHH	HHH			HHH	HHH					Y	Y	S	S		S	S	S	S	S	S	S
B344	BARN SWALLOW	RFR L	L L	HHH			L L	HHH			L L	HHH			L L	HHH					N	N	S	S		S	S	S	S	S	S	S
B345	GRAY JAY	MCN H	H L	H L	H L	H L	H L	H L	H L	H L	H L	HLM	HLM	HMM	HMM	HMM	HMM	HHH	HHH	HHH	Y	Y				Y	Y	W				
B345	GRAY JAY	RFR H	H L	H L	H L	H L	H L	H L	H L	H L	H L	HLM	HLM	HMM	HMM	HMM	HMM	HHH	HHH	HHH	Y	Y				Y	Y	W				
B346	STELLER'S JAY	MCN H	H L	H L	H M	HLM	H M	H H	HMH	HHH	H H	H H	HHH	HHH	H H	H H	H H	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B346	STELLER'S JAY	PPN H	H L	H L	H M	HLM	H H	H H	HMH	HHH	H H	H H	HHH	HHH	H H	H H	H H	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B346	STELLER'S JAY	RFR M	M L	M L	M M	M M	M M	M M	MLM	MMM	M M	M M	MMM	MMM	M M	M M	MMM	MMM	HHH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B349	PINYON JAY	PPN M	M L	M L	M L	M L	M M	M M	M M	M M	MLM	MLM	MLM	M M	MLM	MLM	MLM	M M			Y	Y	Y	Y		Y	Y	Y	Y	Y		Y
B350	CLARK'S NUTCRACKER	MCN					L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B350	CLARK'S NUTCRACKER	PPN					L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B350	CLARK'S NUTCRACKER	RFR					H L	H L	HLL	HLL	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	L L		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B353	AMERICAN CROW	MCN L	L	L			L L	L L			L L	L L			L L	L L					N	N	Y	Y		S	S	Y	Y	Y	Y	Y
B353	AMERICAN CROW	PPN L	L	L			L L	L L			L L	L L			L L	L L					N	N	Y	Y		S	S	Y	Y	Y	Y	Y
B354	COMMON RAVEN	MCN HHH	HHH	HHH			HHH	HHH			HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B354	COMMON RAVEN	PPN HHH	HHH	HHH			HHH	HHH			HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B354	COMMON RAVEN	RFR MHH	MHH	MHH			MHH	MHH			MHH	MHH	MHH	MHH	MHH	MHH	MHH	MHH			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B356	MOUNTAIN CHICKADEE	MCN	H	H	H	H	HLM	HLM	HLM	HLM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B356	MOUNTAIN CHICKADEE	PPN	H	H	H	H	HLM	HLM	HLM	HLM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS SYSTEM
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ID	NAME		1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6	STAGE		SEASON IN LOCATION								
			FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B356	MOUNTAIN CHICKADEE	RFR		H	H	H	H	HLM	HLM	HLM	HLM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B357	CHESTNUT-BACKED CHICKADEE	MCN	L	L	L	L	L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	Y			Y		Y		Y	Y	Y
B357	CHESTNUT-BACKED CHICKADEE	PPN	M	M	M	M	M	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	MLL	L L	Y	Y	Y			Y		Y		Y	Y	Y
B358	PLAIN TITMOUSE	PPN	L	L	L	L	L	MLL	MLL	MLL	MLL	HMM	HMM	HMM	HMM	HMM	HMM	HMM	HMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B360	BUSHTIT	PPN	L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L		N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B361	RED-BREASTED NUTHATCH	MCN						M L	M L	M L	M L	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B361	RED-BREASTED NUTHATCH	PPN						M L	M L	M L	M L	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B361	RED-BREASTED NUTHATCH	RFR						M L	M L	M L	M L	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B362	WHITE-BREASTED NUTHATCH	MCN		H L	H L	H L	H L	HLM	HLM	HLM	HLM	HMH	HMH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B362	WHITE-BREASTED NUTHATCH	PPN		H L	H L	H L	H L	HLM	HLM	HLM	HLM	HMH	HMH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B362	WHITE-BREASTED NUTHATCH	RFR		H L	H L	H L	H L	M L	M L	M L	M L	MLM	MLM	MLM	MLM	MMM	MMM	MMM	MMM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B363	PYGMY NUTHATCH	MCN		L L	L L	L L	L L	M M	M M	M M	M M	HMH	HMH	HMH	HMH	HHH	HHH	HHH	HHH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B363	PYGMY NUTHATCH	PPN		L L	L L	L L	L L	M M	M M	M M	M M	HMH	HMH	HMH	HMH	HHH	HHH	HHH	HHH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B364	BROWN CREEPER	MCN			L L	L L	L L		M M	MLM	MLM		H H	HHH	HHH	H H	H H	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B364	BROWN CREEPER	PPN			L	L L	L L	M	M L	MMM	MMM	M M	M M	HHH	HHH	H M	H M	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B364	BROWN CREEPER	RFR			L L	L L	L L	M	M M	MLM	MLM	M M	H H	HMH	HMH	H H	H H	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B368	BEWICK'S WREN	MCN		LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B368	BEWICK'S WREN	PPN		LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B369	HOUSE WREN	RFR		L L	L L	L L		L L	L L			L L	L L			L L	L L	L L			N	N	Y	S		Y	S	Y	Y	Y	S	S
B370	WINTER WREN	MCN			L	LLL	MMM		LLL	MMM	MMM		LLL	MMM	MMM		LLL	MMM	HHH	MMM	Y	Y	Y	W		Y	W	Y	Y	Y	Y	Y
B370	WINTER WREN	PPN			L	LLL	MMM		LLL	MMM	MMM		LLL	MMM	MMM		LLL	MMM	MMM	MMM	Y	Y	Y	W		Y	W	Y	Y	Y	Y	Y
B370	WINTER WREN	RFR			L	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL	MMM	N	N	Y	W		Y	W	Y	Y	Y	Y	Y
B375	GOLDEN-CROWNED KINGLET	MCN		M L	M L	M L	M L	HLM	HLM	HMM	HMM	HMM	HMM	HHH	HHH	HMH	HMH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B375	GOLDEN-CROWNED KINGLET	PPN		M L	M L	M L	M L	M L	M L	H M	H M	HLM	HLM	HHH	HHH	HMH	HMH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B375	GOLDEN-CROWNED KINGLET	RFR		M L	M L	M L	M L	HLM	HLM	HMM	HMM	HMM	HMM	HHH	HHH	HMH	HMH	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B376	RUBY-CROWNED KINGLET	MCN	H	HLH	HLH	HLH	HMH	HHH	HHH	HHH	HMH	HHH	HHH	HHH	HMH	HHH	HHH	HHH	HMH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B376	RUBY-CROWNED KINGLET	PPN	H	H M	H M	H M	H M	HMM	HMM	HMM	HLM	HHH	HHH	HMH	HLM	HHH	HHH	HMH	HLM	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B376	RUBY-CROWNED KINGLET	RFR	H	H H	H H	H H	H H	HHH	HHH	HHH	HMH	HHH	HHH	HHH	HMH	HHH	HHH	HHH	HMH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B380	WESTERN BLUEBIRD	MCN	M	M	M			M L	M L			MMM	MMM	MLL		MMM	MMM	MLL			Y	Y	Y	S		Y	Y	Y	Y	Y	Y	Y
B380	WESTERN BLUEBIRD	PPN	M	M	M			M L	M L			MMM	MMM	MLL		MMM	MMM	MLL			Y	Y	Y	S		Y	Y	Y	Y	Y	Y	Y
B380	WESTERN BLUEBIRD	RFR	L	L	L			L L	L L			LLL	LLL	MLL		LLL	LLL	MLL			N	N	Y	S		Y	Y	Y	Y	Y	Y	Y
B381	MOUNTAIN BLUEBIRD	MCN	H	HHH	HMH			HHH	HMH			HHH	HMH								Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B381	MOUNTAIN BLUEBIRD	PPN	H	HHH	HMH			HHH	HMH			HHH	HMH								Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B381	MOUNTAIN BLUEBIRD	RFR	L	LLL	LLL			LLL	LLL			LLL	LLL								N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B382	TOWNSEND'S SOLITAIRE	MCN						HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B382	TOWNSEND'S SOLITAIRE	PPN						HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B382	TOWNSEND'S SOLITAIRE	RFR						MMM	MMM	MLL	HLL	MMM	MMM	MLL	HLL	MMM	MMM	MLL	HLL	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B385	SWAINSON'S THRUSH	MCN				M M	M M			M M	M M			M M	M M			M M	M M	M M	Y	Y	S	S		S	S	S	S	S	S	S
B385	SWAINSON'S THRUSH	PPN				L L	L L			L L	L L			L L	L L			L L	L L	M M	N	N	S	S		S	S	S	S	S	S	S
B385	SWAINSON'S THRUSH	RFR				L L	L L			L L	L L			L L	L L		M M	M M	M M	M M	N	Y	S	S		S	S	S	S	S	S	S
B386	HERMIT THRUSH	MCN		L L	L L	HMM	HMM	M L	HMM	HHH	HHH	M L	HMM	HHH	HHH	M L	HMM	HHH	HHH	HHH	Y	Y	Y	S		Y	S	Y	Y	Y	Y	Y
B386	HERMIT THRUSH	PPN		L L	L L	M M	M M	L L	L L	MLM	HMH	L L	L L	MLM	HMH	L L	L L	MLM	HLM	HHH	Y	Y	Y	S		Y	S	Y	Y	Y	Y	Y
B386	HERMIT THRUSH	RFR		L L	L L	M L	M L	L L	M L	HMM	HHH	L L	M L	HMM	HHH	L L	M L	HMM	HMH	HHH	Y	Y	Y	S		Y	S	Y	Y	Y	Y	Y
B389	AMERICAN ROBIN	MCN	H	HLL	HLL	LLL	LL	HHH	HHH	LMM	LL	HHH	HHH	LMM	LL	HHH	HHH	LMM	LL	MM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B389	AMERICAN ROBIN	PPN	H	HLL	HLL	LLL	LL	HHH	HHH	LMM	LL	HHH	HHH	LMM	LL	HHH	HHH	LMM	LL	MM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B389	AMERICAN ROBIN	RFR	M	MLL	MLL	LLL	LL	MMM	MMM	LLL	LL	MMM	MMM	LLL	LL	MMM	MMM	LLL	LL	MM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B390	VARIED THRUSH	MCN	L	L L	L L	M L	M L	L L	L L	M M	M M	L L	L L	M M	M M	L L	L L	M M	M M	M M	Y	Y	W			W		W	W	W	W	W
B390	VARIED THRUSH	PPN	L	L L	L L	L L	L L	L L	L L	M M	H H	L L	L L	M M	H H	L L	L L	M M	H H	M M	Y	Y	W			W		W	W	W	W	W
B390	VARIED THRUSH	RFR	L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	M M	N	N	W			W		W	W	W	W	W
B391	WRENTIT	MCN	L L	L L	L L	L L		L L	L L	L L		L L	L L			L L	L L				N	N	Y			Y	Y	Y	Y	Y	Y	Y
B391	WRENTIT	PPN	L L	LLL	LLL	L L		LLL	LLL	L L		L L	L L			L L	L L				N	N	Y			Y	Y	Y	Y	Y	Y	Y
B407	CEDAR WAXWING	MCN		L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	W	W		W	W	W	W	W	W	W
B407	CEDAR WAXWING	PPN		L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	W	W		W	W	W	W	W	W	W
B409	NORTHERN SHRIKE	PPN	L	L L				L L				L L				L L					N	N		W		W	W	W				W
B410	LOGGERHEAD SHRIKE	PPN	L	LLL	LLL			LLL	LLL			LLL	LLL								N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B411	EUROPEAN STARLING	MCN	L	L	L	L L	L	LLL	LLL	LLL	L	LLL	LLL	LLL	L	LLL	LLL	LLL	L	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B411	EUROPEAN STARLING	PPN	M	M L	M L	L L	L L	MMM	MMM	LLM	LLL	MMM	MMM	LLM	LLL	MMM	MMM	LLM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B415	SOLITARY VIREO	MCN		M L	MMM	MMM	MLM	MLM	MMM	MMM	MLM	MLM	MMM	MMM	MLM	MLM	MMM	MMM	MLM	MMM	Y	Y	S	S		S	S	S	S	S	S	S
B415	SOLITARY VIREO	PPN		HLM	HHH	HHH	LLM	HLM	HHH	HHH	LLM	HLM	HHH	HHH	LLM	HLM	HHH	HHH	LLM	MMM	Y	Y	S	S		S	S	S	S	S	S	S
B415	SOLITARY VIREO	RFR		M L	MMM	MLM	L L	M L	MMM	MLM	L L	M L	MMM	MLM	L L	M L	MMM	MLM	L L	MMM	Y	Y	S	S		S	S	S	S	S	S	S
B417	HUTTON'S VIREO	PPN		L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	Y			Y		Y	Y	Y	Y	Y
B418	WARBLING VIREO	MCN		LLL	LLL	LLL	L L	MLM	MLM	MLM	L L	MLM	MLM	MLM	L L	MLM	MLM	MLM	L L	MLM	Y	Y	S	S		S	S	S	S	S	S	S
B418	WARBLING VIREO	PPN		MLL	MLL	MLL	L L	MLM	MMM	MMM	L L	MLM	MLM	MLM	L L	MLM	MLM	MLM	L L	MLM	Y	Y	S	S		S	S	S	S	S	S	S
B418	WARBLING VIREO	RFR		LLL	LLL	LLL	L	LLL	LLL	LLL	L	LLL	LLL	LLL	L	LLL	LLL	LLL	L	MLM	N	N	S	S		S	S	S	S	S	S	S
B425	ORANGE-CROWNED WARBLER	MCN		M L	M L	M M	M M	M L	M L	M M	M M	M L	M L	M M	M M	M	M	M	M	M	Y	Y	Y	S		Y	S	S	Y	Y	Y	Y
B425	ORANGE-CROWNED WARBLER	PPN		M L	M L	M M	M M	M L	M L	M M	M M	M L	M L	M L	M L	M L	M L	M L	M L	M	Y	Y	Y	S		Y	S	S	Y	Y	Y	Y
B425	ORANGE-CROWNED WARBLER	RFR		M L	M L	M M	M M	M L	M L	M M	M M	M L	M L	M M	M M	M	M	M	M	M	Y	Y	Y	S		Y	S	S	Y	Y	Y	Y
B426	NASHVILLE WARBLER	MCN		HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	H	H	H	H	H	Y	Y	S	S		S	S	S	S	S	S	S
B426	NASHVILLE WARBLER	PPN		HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL	H	H	H	H	H	Y	Y	S	S		S	S	S	S	S	S	S
B426	NASHVILLE WARBLER	RFR		M M	M M	M M	L L	M M	M M	L L	L L	M M	M M	L L	L L	M M	M M	L L	L H		Y	Y	S	S		S	S	S	S	S	S	S
B427	VIRGINIA'S WARBLER	MCN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		L L	L L	L L			N	N		S						S		
B430	YELLOW WARBLER	MCN		HLM	HHH	HHH	HMM	HMM	HHH	HHH	HMM	HMM	HHH	HHH	HLM	H M	H M	H M	H M	H M	Y	Y	S	S		S	S	S	S	S	S	S

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ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B430	YELLOW WARBLER	PPN		HLM	HHH	HHH	HMM	HMM	HHH	HHH	HMM	HMM	HHH	HHH	HLM	H M	H M	H M	H M	H M	Y	Y	S	S		S	S	S	S	S	S	S
B430	YELLOW WARBLER	RFR		L L	L L	L L	HMM	L L	L L	L L	HMM	L L	L L	L L	HLM	L L	L L	L L	H M	H M	N	N	S	S		S	S	S	S	S	S	S
B435	YELLOW-RUMPED WARBLER	MCN	H	HLM	HMM	HMM	HLM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B435	YELLOW-RUMPED WARBLER	PPN	H	HLM	HMM	HMM	HLM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B435	YELLOW-RUMPED WARBLER	RFR	M	MLM	MMM	MMM	MLM	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B436	BLACK-THROATED GRAY WARBLER	MCN		M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	Y	Y	Y	S		S	S	S	S	S	Y	Y
B436	BLACK-THROATED GRAY WARBLER	PPN		HMM	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HMM	HMM	HMM	HMM	HMM	M M	Y	Y	Y	S		S	S	S	S	S	Y	Y
B436	BLACK-THROATED GRAY WARBLER	RFR		L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	M M	N	N	Y	S		S	S	S	S	S	Y	Y
B438	HERMIT WARBLER	MCN		L	L	L	L	MLL	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HHH	Y	Y	S			S	S	S	S	S	S	S
B438	HERMIT WARBLER	PPN		L	L	L	L	MLL	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HHH	Y	Y	S			S	S	S	S	S	S	S
B438	HERMIT WARBLER	RFR		L	L	L	L	MLL	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HMM	HHH	HHH	HHH	HHH	Y	Y	S			S	S	S	S	S	S	S
B463	WILSON'S WARBLER	MCN	M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	M M	L L	L L	L L	L L	L L	Y	N	S	S		S	S	S	S	S	S	S
B463	WILSON'S WARBLER	PPN	M	M M	M M	M M	M M	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	Y	N	S	S		S	S	S	S	S	S	S
B463	WILSON'S WARBLER	RFR	L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	N	N	S	S		S	S	S	S	S	S	S
B471	WESTERN TANAGER	MCN		L	L	L	L	MLL	MMM	MMM	MMM	MMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B471	WESTERN TANAGER	PPN		L	L	L	L	HLL	HMM	HMM	HMM	HMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B471	WESTERN TANAGER	RFR		L	L	L	L	MLL	MMM	MMM	MMM	MMM	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	Y	Y	S	S		S	S	S	S	S	S	S
B475	BLACK-HEADED GROSBEAK	MCN	L	L	L	L	L	LLL	LLL	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	MMM	Y	Y	S	S		S	S	S	S	S	S	S
B475	BLACK-HEADED GROSBEAK	PPN	L	L	L	L	L	LLL	LLL	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	MMM	Y	Y	S	S		S	S	S	S	S	S	S
B477	LAZULI BUNTING	MCN	L	LLL	LLL			LLL	LLL			LLL				LLL					N	N	S	S		S	S	S	S	S	S	S
B477	LAZULI BUNTING	PPN	L	LLL	LLL			LLL	LLL			LLL				LLL					N	N	S	S		S	S	S	S	S	S	S
B482	GREEN-TAILED TOWHEE	MCN	HMM	HHH	HMM			HHH				HHH				HMM					Y	Y	S	S		S	S	S	S	S	S	S
B482	GREEN-TAILED TOWHEE	PPN	HMM	HHH	HMM			HHH				HHH				HMM					Y	Y	S	S		S	S	S	S	S	S	S
B483	RUFOUS-SIDED TOWHEE	MCN	MLL	MMM	MMM	LLL		MMM	MMM	LLL		M M	M M	L L		M M	M M	L L			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B483	RUFOUS-SIDED TOWHEE	PPN	MLL	MMM	MMM	LLL		MMM	MMM	LLL		M M	M M	L L		M M	M M	L L			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B484	BROWN TOWHEE	PPN	LLL	LLL	LLL	LLL		LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y			Y	Y		Y	Y	Y	Y
B489	CHIPPING SPARROW	MCN	H	HHH	HHH	MMM		HHH	HHH	MMM		HHH	HHH	MMM		HHH	MMM				Y	Y	S	S		S	S	S	S	S	S	S
B489	CHIPPING SPARROW	PPN	H	HHH	HHH	MMM		HHH	HHH	MMM		HHH	HHH	MMM		HHH	MMM				Y	Y	S	S		S	S	S	S	S	S	S
B489	CHIPPING SPARROW	RFR	M	MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM				Y	Y	S	S		S	S	S	S	S	S	S
B495	LARK SPARROW	PPN	LLL	LLL				LLL				LLL				LLL					N	N	Y	S		Y	S	S	Y	Y	Y	Y
B504	FOX SPARROW	MCN	HHH	HHH	HHH	MMM		HHH	HHH	MMM		HHH	HHH	MMM		HHH	MMM	LLL			Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B504	FOX SPARROW	PPN	MMM	MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B504	FOX SPARROW	RFR	MMM	MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B505	SONG SPARROW	MCN	LLL	LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B505	SONG SPARROW	PPN	MMM	MMM	LLL			MMM	LLL			LLL	LLL			LLL	LLL				Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B506	LINCOLN'S SPARROW	MCN	L L	L L				L L				L L				L L					N	N	Y	Y		Y	S	Y	Y	Y	Y	Y

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B506	LINCOLN'S SPARROW	PPN	L L	L L				L L				L L				L L					N	N	Y	Y		Y	S	Y	Y	Y	Y	Y
B509	GOLDEN-CROWNED SPARROW	MCN	L L	L L	L L			L L	L L			L L	L L			L L	L L				N	N	W	W		W	W	W	W	W	W	W
B509	GOLDEN-CROWNED SPARROW	PPN	L L	L L	L L			L L	L L			L L	L L			L L	L L				N	N	W	W		W	W	W	W	W	W	W
B509	GOLDEN-CROWNED SPARROW	RFR	L L	L L	L L			L L	L L			L L	L L			L L	L L				N	N	W	W		W	W	W	W	W	W	W
B510	WHITE-CROWNED SPARROW	MCN	L L	L L	L L			L L				L L				L L					N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B510	WHITE-CROWNED SPARROW	PPN	M M	M M	L L			L L				L L				L L					Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B510	WHITE-CROWNED SPARROW	RFR	L L	L L	L L			L L	L L			L L	L L			L L	L L				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B512	DARK-EYED JUNCO	MCN	HHH	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B512	DARK-EYED JUNCO	PPN	HHH	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B512	DARK-EYED JUNCO	RFR	HHH	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL	HHH	HHH	MMM	MLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B521	WESTERN MEADOWLARK	MCN	LLL	LLL				LLL				LLL				LLL					N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B521	WESTERN MEADOWLARK	PPN	LLL	LLL	LLL			LLL	LLL			LLL	L L			LLL	L L				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B521	WESTERN MEADOWLARK	RFR	L L	L L	LLL			L L	LLL			L L	L L			L L	L L				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B524	BREWER'S BLACKBIRD	MCN	M L	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B524	BREWER'S BLACKBIRD	PPN	M L	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B524	BREWER'S BLACKBIRD	RFR	L L	L L	L L	LMM	LMM	L L	L L	LMM	LMM	L L	MLL	LMM	LMM	L L	MLL	LMM	LMM		N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B528	BROWN-HEADED COWBIRD	MCN	M	MLL	LLL	LL	LL	MMM	LMM	LL	LL	MMM	LMM	LL	LL	MMM	LMM	LL	LL	LL	Y	Y	Y	S		Y	S	Y	Y	Y	Y	Y
B528	BROWN-HEADED COWBIRD	PPN	M	MLL	LLL	LL	LL	MMM	LMM	LL	LL	MMM	LMM	LL	LL	MMM	LMM	LL	LL	LL	Y	Y	Y	S		Y	S	Y	Y	Y	Y	Y
B528	BROWN-HEADED COWBIRD	RFR	L	LLL	LLL	LL	LL	LLL	LLL	LL	LL	LLL	LLL	LL	LL	LLL	LLL	LL	LL	LL	N	N	Y	S		Y	S	Y	Y	Y	Y	Y
B532	NORTHERN ORIOLE	PPN	L	L	L			L	L			MLL	MLL			MMM	MMM				Y	Y	S	S		S	S	S	S	S	S	S
B535	PINE GROSBEAK	RFR	H	H	H	H	H	H L	H L	H L	H L	HHH	HHH	HMM	HLL	HHH	HHH	HMM	HLL		Y	Y	Y	Y		W		Y	Y	Y	Y	Y
B536	PURPLE FINCH	MCN	L	M	M	M		M	M	M		MLL	HMM	HHH	MMM	MLL	HMM	HHH	MMM	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B536	PURPLE FINCH	PPN	L	L	L	L		M	M	L		MLL	MMM	MMM	LLL	MLL	MMM	MMM	LLL	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B537	CASSIN'S FINCH	MCN	H	H	H	M		MLL	MLL	M L		HMM	HMM	HLL		HHH	HHH	HLL		HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B537	CASSIN'S FINCH	PPN	L	L	L	L		L L	L L	L L		LLL	LLL	L L		LLL	LLL	L L		HHH	N	N	Y	Y		Y	S	Y	Y	Y	Y	Y
B537	CASSIN'S FINCH	RFR	H	H	H	M		HLL	HLL	MLL		HHH	HHH	HMM	MLL	HHH	HHH	HMM	MLL	HHH	Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y
B538	HOUSE FINCH	MCN	L L	MMM	LLL			MMM	LLL			MMM	LLL			MMM	LLL				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B538	HOUSE FINCH	PPN	L L	LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B539	RED CROSSBILL	MCN						L L	L L	L L	L L	LLL	MLL	MLL	MLL	HLL	HMM	HMM	HLL	HMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B539	RED CROSSBILL	PPN						L L	L L	L L	L L	LLL	MLL	MLL	MLL	HLL	HMM	HMM	HLL	HMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B539	RED CROSSBILL	RFR						L L	L L	L L	L L	LLL	MLL	MLL	MLL	HLL	HMM	HMM	HLL	HMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B542	PINE SISKIN	MCN	M	M	M	L		MLL	MLL	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B542	PINE SISKIN	PPN	M	M	M	L		M L	M L	L L		MLM	MLM	LLL		MLM	MLM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B542	PINE SISKIN	RFR	M	M	M	L		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B543	LESSER GOLDFINCH	MCN	L	LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	S	Y	Y	Y	Y	Y
B543	LESSER GOLDFINCH	PPN	M	MMM	LLL			MMM	LLL			MMM	LLL			MMM	LLL				Y	Y	Y	Y		Y	S	Y	Y	Y	Y	Y

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ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
B543	LESSER GOLDFINCH	RFR	L	L L	L L			L L	L L			L L	L L			L L	L L				N	N	Y	Y		Y	S	Y	Y	Y	Y	Y
B544	LAWRENCE'S GOLDFINCH	PPN	L	LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	S			S			S	S	S	S
B546	EVENING GROSBEAK	MCN		L	L	L	L	L L	L L	M L	M L	H L	HMM	HHH	HHH	H L	HMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
B546	EVENING GROSBEAK	PPN		L	L	L	L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	L L	HHH	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
B546	EVENING GROSBEAK	RFR		L	L	L	L	M L	M L	M M	M M	M L	MMM	HHH	HHH	M L	MMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M001	VIRGINIA OPOSSUM	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y		Y	Y	Y	Y	Y
M001	VIRGINIA OPOSSUM	PPN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	LLL	Y	Y	Y			Y		Y	Y	Y	Y	Y
M003	VAGRANT SHREW	MCN		LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y			Y	Y
M003	VAGRANT SHREW	PPN		LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y			Y	Y
M003	VAGRANT SHREW	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y			Y	Y
M004	DUSKY SHREW	MCN						LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y					Y	Y	Y	
M004	DUSKY SHREW	PPN						LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y					Y	Y	Y	
M004	DUSKY SHREW	RFR						LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y					Y	Y	Y	
M006	ORNATE SHREW	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	LLL	Y	Y	Y						Y	Y	Y	Y
M006	ORNATE SHREW	PPN	LLL	LLL	LLL	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	MMM	MMM	HHH	HHH	MMM	MMM	LLL	Y	Y	Y						Y	Y	Y	Y
M010	WATER SHREW	MCN											LLL	LLL	LLL			LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M010	WATER SHREW	RFR								MMM	MMM		LLL	MMM	MMM		LLL	MMM	MMM	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M012	TROWBRIDGE'S SHREW	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	MMM	MMM	MMM	HHH	HHH	MMM	MMM	HHH	HHH	HHH	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
M012	TROWBRIDGE'S SHREW	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	MMM	MMM	MMM	HHH	HHH	MMM	MMM	HHH	HHH	HHH	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
M012	TROWBRIDGE'S SHREW	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	HHH	N	N	Y			Y	Y	Y	Y	Y	Y	Y
M015	SHREW-MOLE	MCN									LLL		L	MMM	MMM			H H	HHH	HHH	Y	Y				Y		Y				
M018	BROAD-FOOTED MOLE	MCN		LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M018	BROAD-FOOTED MOLE	PPN		LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M018	BROAD-FOOTED MOLE	RFR		LLL	LLL			LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M021	LITTLE BROWN MYOTIS	MCN	M	M	M	M	L	M L	M L	M L	L L	M L	M L	M L	L L	M L	M L	L L	L L	L L	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M021	LITTLE BROWN MYOTIS	PPN	M	M	M	M	L	M L	M L	M L	L L	M L	M L	M L	L L	M L	M L	L L	L L	L L	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M021	LITTLE BROWN MYOTIS	RFR	M	M	M	M	L	M L	M L	M L	L L	M L	M L	M L	L L	M L	M L	L L	L L	L L	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M023	YUMA MYOTIS	MCN	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M023	YUMA MYOTIS	PPN	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M023	YUMA MYOTIS	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M025	LONG-EARED MYOTIS	MCN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M025	LONG-EARED MYOTIS	PPN	LLL	LLL	LLL	LLL	LLL	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M025	LONG-EARED MYOTIS	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M026	FRINGED MYOTIS	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M026	FRINGED MYOTIS	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M026	FRINGED MYOTIS	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y

ID	NAME		1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6	STAGE		SEASON IN LOCATION								
			FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
M027	LONG-LEGGED MYOTIS	MCN	MMM	MMM	MMM	MMM	MMM	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M027	LONG-LEGGED MYOTIS	PPN	MMM	MMM	MMM	MMM	MMM	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	HHH	HHH	MHH	LHH	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M027	LONG-LEGGED MYOTIS	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M028	CALIFORNIA MYOTIS	MCN	MMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M028	CALIFORNIA MYOTIS	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LMM	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M028	CALIFORNIA MYOTIS	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LMM	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M029	SMALL-FOOTED MYOTIS	MCN	MLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M029	SMALL-FOOTED MYOTIS	PPN	MLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M030	SILVER-HAIRED BAT	MCN	M	M	M	M	M	MMM	MMM	MMM	LMM	HHH	HHH	MMM	LMM	HHH	HHH	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M030	SILVER-HAIRED BAT	PPN	M	M	M	M	L	MMM	MMM	MMM	LMM	HHH	HHH	MMM	LMM	HHH	HHH	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M030	SILVER-HAIRED BAT	RFR	M	M	M	M	L	MMM	MMM	MMM	LMM	HHH	HHH	MMM	LMM	HHH	HHH	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M031	WESTERN PIPISTRELLE	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y		Y	Y	Y	Y	Y
M031	WESTERN PIPISTRELLE	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y		Y	Y	Y	Y	Y
M032	BIG BROWN BAT	MCN	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH	HHH		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M032	BIG BROWN BAT	PPN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M032	BIG BROWN BAT	RFR	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M033	RED BAT	MCN	M	M	M	M	L	MMM	MMM	LMM	MMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	LMM	Y	Y	Y			Y		Y	Y	Y	Y	Y
M033	RED BAT	PPN	M	M	M	M	L	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	LMM	Y	Y	Y			Y		Y	Y	Y	Y	Y
M034	HOARY BAT	MCN	M	M	M	M	L	MMM	MMM	MMM	LMM	HHH	HHH	MMM	LMM	HHH	HHH	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M034	HOARY BAT	PPN	M	M	M	M	L	MMM	MMM	MMM	LMM	HHH	HHH	MMM	LMM	HHH	HHH	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M034	HOARY BAT	RFR	M	M	M	M	L	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	MMM	MMM	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M036	SPOTTED BAT	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y					Y	Y	Y	
M036	SPOTTED BAT	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y					Y	Y	Y	
M037	TOWNSEND'S BIG-EARED BAT	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M037	TOWNSEND'S BIG-EARED BAT	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M037	TOWNSEND'S BIG-EARED BAT	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M038	PALLID BAT	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M038	PALLID BAT	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M038	PALLID BAT	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M039	BRAZILIAN FREE-TAILED BAT	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M039	BRAZILIAN FREE-TAILED BAT	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M039	BRAZILIAN FREE-TAILED BAT	RFR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M042	WESTERN MASTIFF BAT	PPN	M	M	L	L		M	L	L		M	L	L		M	L	L			Y	Y	Y						Y	Y	Y	
M043	PIKA	MCN	L	L	L			L	L			L	L			L	L				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M043	PIKA	PPN	L	L	L			L	L			L	L			L	L				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M043	PIKA	RFR	L	L	L			L	L			L	L			L	L				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y

ID	NAME		1		2S		2P		2M		2D		3S		3P		3M		3D		4S		4P		4M		4D		5S		5P		5M		5D		6		STAGE		SEASON IN LOCATION									
			FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		FRC		YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
M045	BRUSH RABBIT	MCN	HMM		HHH		HHH		MHH		LMM		LLL		LLL						LLL		LLL														Y	N	Y			Y		Y	Y	Y	Y	Y
M045	BRUSH RABBIT	PPN	MLL		MMM		MMM		MMM		LLL		LLL		LLL						LLL		LLL														Y	N	Y			Y		Y	Y	Y	Y	Y
M049	SNOWSHOE HARE	MCN			LLL		LLL		LLL		LLL		LLL		LLL																						N	N	Y	Y		Y	Y	Y		Y	Y	Y
M049	SNOWSHOE HARE	RFR			LLL		LLL		LLL		LLL		LLL		LLL																						N	N	Y	Y		Y	Y	Y		Y	Y	Y
M050	WHITE-TAILED HARE	RFR					LLL		LLL		LLL		LLL		LLL		LLL																				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M051	BLACK-TAILED HARE	MCN	HHH		MLL		MMM		LLM		LLL		MLL		MLL		LLM				MLL		LLL						LLL								Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M051	BLACK-TAILED HARE	PPN	LLL		HHL		HHL		MMH		LLL		MML		HHM		MMH				MML		MMM		LLM				LLL		LLL						Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M051	BLACK-TAILED HARE	RFR	LLL		LLL		LLM		LLL		LLL		LLL		LLL		LLL				LLL		LLL		LLM				LLL		LLL						Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M052	MOUNTAIN BEAVER	MCN	MMM		HHH		HHH		MMM				HHH		HHH		MMM				HHH		HHH		MMM				MMM		MMM				MMM		Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
M052	MOUNTAIN BEAVER	PPN	L		LLL		MMM		MMM		MMM		LLL		MMM		MMM		MMM		LLL		MMM		MMM		MMM		MMM		MMM		MMM		MMM		Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
M052	MOUNTAIN BEAVER	RFR	LLL		MMM		MMM		MMM		MMM		MMM		MMM		LLL		MMM		LLL		LLL		LLL		MMM		LLL		LLL		MMM		MMM		Y	N	Y	Y		Y		Y	Y	Y	Y	Y
M055	YELLOW-PINE CHIPMUNK	MCN	MMM		MMM		MMM		MMM		MMM		HHH		HHH		HHH		LLL		HHH		HHH		HHH		LLL		HHH		HHH		HHH		LLL		Y	Y	Y	Y		Y	Y	Y		Y	Y	Y
M055	YELLOW-PINE CHIPMUNK	PPN	MMM		MMM		MMM		HHH		LLL		HHH		HHH		HHH		LLL		HHH		HHH		HHH		LLL		HHH		HHH		HHH		LLL		Y	Y	Y	Y		Y	Y	Y		Y	Y	Y
M055	YELLOW-PINE CHIPMUNK	RFR	LLL		HHH		HHH		MMM		LLL		MMM		HHH		HHH		LLL		MMM		HHH		HHH		LLL		MMM		HHH		HHH		LLL		Y	Y	Y	Y		Y	Y	Y		Y	Y	Y
M057	ALLEN'S CHIPMUNK	MCN	L		MMM		HHH		HHH		HHH		MMM		MMM		MMM		LLL		HHH		MMM		MMM		LLL		HHH		HHH		HHH		LLL		Y	Y	Y	Y		Y	Y	Y		Y	Y	Y
M057	ALLEN'S CHIPMUNK	PPN	L		MMM		MMM		HHH		HHH		HHH		HHH		MMM		MMM		HHH		HHH		MLM		LLL		HHH		HHH		HHH		MMM		LLL		Y	Y	Y	Y		Y	Y	Y		Y	Y	Y
M057	ALLEN'S CHIPMUNK	RFR	L		MMM		MMM		MMM		HHH		MMM		MMM		MMM		LLL		HHH		MMM		MMM		LLL		HHH		HHH		MMM		LLL		LLL		Y	Y	Y	Y		Y	Y	Y		Y	Y	Y
M060	MERRIAM'S CHIPMUNK	MCN	MMM		HHH		HHH		HHH		HHH		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		Y	N							Y	Y	Y	
M060	MERRIAM'S CHIPMUNK	PPN	MMM		HHH		HHH		HHH		HHH		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		LLL		Y	Y							Y	Y	Y	
M062	LONG-EARED CHIPMUNK	MCN			MMM		HHH		HHH		MMM		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		LLL		Y	Y	Y			Y		Y		Y	Y	Y
M062	LONG-EARED CHIPMUNK	PPN			MMM		HHH		HHH		MMM		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		LLL		Y	Y	Y			Y		Y		Y	Y	Y
M063	LODGEPOLE CHIPMUNK	MCN											MMM		MMM		LLL				MMM		MMM		LLL		LLL		MMM		MMM		MMM		LLL		LLL		Y	Y	Y		Y		Y	Y	Y	Y	Y
M063	LODGEPOLE CHIPMUNK	RFR			LLL		LLL						LLL		LLL		LLL				LLL		LLL		LLL		LLL		LLL		LLL		MMM		LLL		LLL		N	N	Y	Y		Y		Y	Y	Y	Y	Y
M066	YELLOW-BELLIED MARMOT	MCN	MMM		MMM		MMM		LLL				MMM		MMM		LLL				MMM		MMM		LLL				MMM		MMM		LLL						Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M066	YELLOW-BELLIED MARMOT	RFR	MMM		MMM		MMM		LLL				MMM		MMM		LLL				MMM		MMM		LLL				MMM		MMM		LLL						Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M070	BELDING'S GROUND SQUIRREL	MCN	LLL		LLL		LLL						LLL		LLL																						N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M070	BELDING'S GROUND SQUIRREL	RFR	LLL		LLL		LLL						LLL		LLL																						N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M072	CALIFORNIA GROUND SQUIRREL	MCN	HHH		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M072	CALIFORNIA GROUND SQUIRREL	PPN	HHH		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		MMM		MMM		LLL		LLL		LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M072	CALIFORNIA GROUND SQUIRREL	RFR	MMM		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		LLL		Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M075	GOLDEN-MANTLED GROUND SQUIRREL	MCN	HMM		HMM		HHH		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		MMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M075	GOLDEN-MANTLED GROUND SQUIRREL	PPN	HMM		HHH		MMM		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		MMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M075	GOLDEN-MANTLED GROUND SQUIRREL	RFR	HMM		HHH		HHH		MHH		MMM		HHH		HHH		MMM		LLL		HHH		HHH		MMM		LLL		HHH		HMM		MMM		LLL		MMM		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M077	WESTERN GRAY SQUIRREL	MCN	L		L		L		L		L		LLL		LLL		LLL		LLL		LLL		LLL		MMM		MMM		MMM		MMM		MMM		LLL		LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M077	WESTERN GRAY SQUIRREL	PPN	L		L		L		L		L		LLL		MMM		MMM		MMM		LLL		MMM		MMM		HHH		HHH		HHH		HHH		MMM		LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M079	DOUGLAS' SQUIRREL	MCN																	LLL		LLL		L		L		MMM		HHH		MMM		MMM		HHH		HHH		HHH		Y	Y	Y		Y		Y	Y	Y	Y	Y

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
M079	DOUGLAS' SQUIRREL	PPN								LLL	LLL	L	L	MMM	HHH	MMM	MMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M079	DOUGLAS' SQUIRREL	RFR							L	LLL	LLL	L	L	MMM	HHH	MMM	MMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M080	NORTHERN FLYING SQUIRREL	MCN					LLL		LLL	MMM	MMM		LLL	MMM	HHH	MMM	MMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M080	NORTHERN FLYING SQUIRREL	PPN					LLL	LLL	LLL	LLL	MMM	LLL	LLL	LLL	MMM	LLL	LLL	MMM	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M080	NORTHERN FLYING SQUIRREL	RFR					LLL	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	MMM	MMM	HHH	HHH	HHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M081	BOTTA'S POCKET GOPHER	MCN	HHH	MMM	MMM	LLL		MMM	LLL			MMM	LLL			LLL	LLL				Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M081	BOTTA'S POCKET GOPHER	PPN	HHH	MMM	MMM	LLL		MMM	LLL			MMM	LLL			MMM	LLL				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M081	BOTTA'S POCKET GOPHER	RFR	MMM	LLL	LLL	LLL		LLL	LLL			LLL	LLL			LLL	LLL				Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M083	NORTHERN POCKET GOPHER	MCN	MMM	MMM	MMM	MMM		LLL	LLL			LLL	LLL			LLL	LLL				Y	N		Y		Y	Y	Y				Y
M083	NORTHERN POCKET GOPHER	RFR	LLL	LLL	LLL	MMM		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N		Y		Y	Y	Y				Y
M085	MOUNTAIN POCKET GOPHER	MCN	MMM	MMM	MMM	MMM	LLL	LLL	LLL			LLL	LLL			LLL	LLL				Y	N	Y	Y		Y	Y	Y		Y	Y	Y
M085	MOUNTAIN POCKET GOPHER	PPN	HHH	MMM	LLL	MMM	LLL	LLL	LLL			LLL	LLL			LLL	LLL				Y	N	Y	Y		Y	Y	Y		Y	Y	Y
M085	MOUNTAIN POCKET GOPHER	RFR	MMM	MMM	MMM	MMM	LLL	LLL	LLL			LLL	LLL			LLL	LLL				Y	N	Y	Y		Y	Y	Y		Y	Y	Y
M088	GREAT BASIN POCKET MOUSE	MCN	LLL	LLL				LLL				LLL				LLL					N	N		Y		Y	Y	Y		Y		Y
M088	GREAT BASIN POCKET MOUSE	PPN	LLL	LLL	LLL	LLL		LLL				LLL				LLL					N	N		Y		Y	Y	Y		Y		Y
M103	PACIFIC KANGAROO RAT	PPN	LLL	LLL	LLL			LLL				LLL				LLL					N	N							Y			
M112	BEAVER	MCN				L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y			Y	Y
M112	BEAVER	RFR		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	N	N	Y	Y		Y	Y	Y			Y	Y
M113	WESTERN HARVEST MOUSE	MCN	LLL	LLL	LLL	LLL	LLL	LLL				LLL				LLL					N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M113	WESTERN HARVEST MOUSE	PPN	MM	MMM	LLL	LLL	LLL	MMM	LLL	LLL		MMM	MMM	LLL		MMM	LLL	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M113	WESTERN HARVEST MOUSE	RFR	LLL	LLL	LLL	LLL	LLL	MMM	LLL	LLL		MMM	MMM	LLL		MMM	LLL	LLL			N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M116	CALIFORNIA MOUSE	MCN	MMM	MMM	MMM	MMM	LLL	LLL	LLL			LLL	LLL								Y	N							Y	Y	Y	
M116	CALIFORNIA MOUSE	PPN	HHH	HHH	HHH	HHH	LLL	LLL	LLL			LLL	LLL								Y	N							Y	Y	Y	
M117	DEER MOUSE	MCN	HHH	HHH	HHH	HHH	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M117	DEER MOUSE	PPN	HHH	HHH	HHH	HHH	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M117	DEER MOUSE	RFR	HHH	HHH	HHH	HHH	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M119	BRUSH MOUSE	MCN	HHH	HHH	MMM	MMM		MMM	MMM			MMM	MMM			MMM	MMM				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M119	BRUSH MOUSE	PPN	MMM	MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL		LLL	LLL				Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M120	PINYON MOUSE	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M120	PINYON MOUSE	PPN	LLL	HHH	HHH	HHH	HHH	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M121	NORTHERN GRASSHOPPER MOUSE	MCN	MMM	MMM	MMM	MMM		LLL				LLL				LLL					Y	N		Y			Y	Y				Y
M127	DUSKY-FOOTED WOODRAT	MCN	MMM	MMM	MMM	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
M127	DUSKY-FOOTED WOODRAT	PPN	MMM	MMM	MMM	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
M128	BUSHY-TAILED WOODRAT	MCN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	MMM	MMM	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M128	BUSHY-TAILED WOODRAT	RFR	HHH	HHH	HHH	MMM	MMM	HHH	HHH	MMM	MMM	HHH	HHH	MMM	MMM	HHH	HHH	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M129	WESTERN RED-BACKED VOLE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	LLL	LLL	LLL	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y				Y		Y				

ID	NAME		1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6	STAGE		SEASON IN LOCATION									
			FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
M129	WESTERN RED-BACKED VOLE	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	MMM	LLL	LLL	LLL	MMM	MMM	MMM	MMM	MMM	MMM	Y	Y				Y		Y				
M130	HEATHER VOLE	MCN	MMM	MMM	LLL	LLL		MMM	LLL	LLL		MMM	MMM	MMM		MMM	LLL	LLL			Y	Y	Y	Y					Y	Y	Y
M130	HEATHER VOLE	RFR	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	LLL	LLL		Y	Y	Y	Y					Y	Y	Y
M133	MONTANE VOLE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M133	MONTANE VOLE	PPN	MMM	MMM	MMM	LLL	LLL	MMM	LLL	LLL	LLL	MMM	LLL	LLL	LLL	MMM	LLL	LLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M133	MONTANE VOLE	RFR	MMM	MMM	LLL	LLL	LLL	MMM	LLL	LLL	LLL	MMM	LLL	LLL	LLL	MMM	LLL	LLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M134	CALIFORNIA VOLE	MCN	MMM	MMM	MMM	LLL		LLL													Y	N	Y	Y		Y			Y	Y	Y	Y
M134	CALIFORNIA VOLE	PPN	LLL	LLL	LLL	LLL	LLL	LLL													N	N	Y	Y		Y			Y	Y	Y	Y
M136	LONG-TAILED VOLE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M136	LONG-TAILED VOLE	PPN	MMM	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M136	LONG-TAILED VOLE	RFR	HHH	HHH	HHH	HHH	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M142	HOUSE MOUSE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M143	WESTERN JUMPING MOUSE	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M143	WESTERN JUMPING MOUSE	RFR	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M145	PORCUPINE	MCN	M	M	M	M	M	HMM	HMM	MMM	MHM	HMM	HMM	MMM	MHM	HMM	HMM	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M145	PORCUPINE	PPN	M	M	M	M	M	HMM	HMM	MMM	MHM	HMM	HMM	MMM	MHM	HMM	HMM	MMM	LMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M145	PORCUPINE	RFR	M	M	M	M	M	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M146	COYOTE	MCN	HLM	HMM	HHH	MHH	LHH	HMM	HHH	MHH	LHM	MLM	LMM	LML	LLL	MLM	MMM	LLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M146	COYOTE	PPN	HLM	HMM	HHH	MHH	LHH	HMM	HHH	MHH	LML	MLM	LMM	LML	LLL	MLM	LML	LLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M146	COYOTE	RFR	HLM	HMM	HHH	MHH	LHH	HMM	HHH	MHH	LML	MLM	LMM	LML	LLL	MLM	LML	LL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M147	RED FOX	MCN	L	L	L	L	LLL	LLL	LLL	LL	LL	LLL	LLL	LL							N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M147	RED FOX	PPN	L	L	L	L	L	LLL	LLL	LL	LL	LLL	LLL	LL							N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M147	RED FOX	RFR	L	L	L	LLL	LLL	LLL	LLL	LL	LL	LLL	LLL	LL	LL	LLL	LLL				N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M149	GRAY FOX	MCN	H	HMM	HHH	HHH	LHH	HMM	HHH	LMM	LL	MLL	MLL	LLL	LL	LLL	LLL	LL			Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M149	GRAY FOX	PPN	M	HLL	HMM	MMM	LL	HLL	MMM	LMM	LL	MLL	MMM	LMM	LL	MLL	LL	LL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M151	BLACK BEAR	MCN	M	H	L	HLL	HLM	LLL	HLL	HLL	MMM	LMM	HMM	MMM	LMM	LMM	HMM	MMM	MHH	LMM	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M151	BLACK BEAR	PPN	M	H	L	HLL	HLM	LLL	HLL	HLL	MMM	LMM	HMM	MMM	LMM	LMM	HMM	MMM	MHH	LMM	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M151	BLACK BEAR	RFR	M	H	L	HLL	HLM	LLL	MLL	MLL	MMM	LMM	MMM	MMM	LHH	LMM	MMM	LLM	LMM	LLL	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M152	RINGTAIL	MCN	L	MMM	MMM	MMM	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL		LLL	LLL				Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M152	RINGTAIL	PPN	L	MMM	MMM	LMM	LLL	MMM	MMM	LLL	LLL	LLL	LLL	LLL		LLL	LLL				Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M153	RACCOON	MCN	M	L	HLL	HLL	MLM	MLL	HLL	MLL	MLM	LLL	MMM	MMM	MHM	LMM	MMM	MMM	MHH	MHH	MHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M153	RACCOON	PPN	M	L	HLL	HLL	MLM	MLL	HLL	MLL	MLM	LLL	MMM	MMM	MHM	LMM	MMM	MMM	MHH	LHH	MHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M153	RACCOON	RFR	M	L	HLL	HLL	MLM	LLL	HLL	MLL	MLM	LLL	MMM	MMM	MHM	LMM	MMM	MMM	MHH	LHH	MHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M154	MARTEN	MCN		L	L	L	L	L	L	LLL	LLL	L	LLL	MMM	MMM	L	LLL	MMM	MMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M154	MARTEN	PPN	L	L	L	L	L	L	L	L	L	L	LLL	MLM	MLM	L	LLM	MLM	MLM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M154	MARTEN	RFR	L	L	L	L	L	M	M	LLL	LLL	M	MMM	HHH	HHH	L	MMM	HHH	HHH	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
M155	FISHER	MCN							L	L	L L	L	M L	HLM	MHH	M	M L	HMM	HHH	HHH	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
M155	FISHER	PPN							L	L	L L	L	M	HLM	MHH	M	M L	HMM	HHH	HHH	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
M155	FISHER	RFR							L	L	L L	L	M L	HLM	MHH	M	M L	HMM	HHH	HHH	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
M156	ERMINE	MCN	HLL	HLL	MLL	LLL	LLL	MLL	MLL	LLL	LLL	MLL	MMM	MHH	LHH	HMM	MMM	MHH	LHH	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M156	ERMINE	PPN	MLL	MLL	MLL	MLL	LLL	MLL	MLL	MLL	LMM	MLL	MMM	MMM	LHH	MLL	MMM	MMM	LHH	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M156	ERMINE	RFR	HLL	HLL	MLL	LLL	LLL	MLL	MLL	LLL	LLL	MLL	MMM	MHH	LHH	HMM	MMM	MHH	LHH	LHH	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M157	LONG-TAILED WEASEL	MCN	HMM	HMM	HHH	MHH	MMM	HMM	HHH	MMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M157	LONG-TAILED WEASEL	PPN	HMM	HMM	HHH	MHH	MMM	HMM	HHH	MMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M157	LONG-TAILED WEASEL	RFR	HMM	HMH	HHH	MHH	MMM	HMM	HHH	MMM	LMM	MLL	MLL	LMM	LMM	MLL	MLL	LMM	LMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M159	WOLVERINE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y		Y	Y	Y	Y	Y
M159	WOLVERINE	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y		Y	Y	Y	Y	Y
M160	BADGER	MCN	HHH	MMM	LLL			LLL	LLL												Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M160	BADGER	PPN	HHH	MMM	LLL			LLL	LLL			LLL									Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M160	BADGER	RFR	MMM	LLL	LLL			LLL	LLL			LLL									Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M161	WESTERN SPOTTED SKUNK	MCN	MLL	MMM	HHH	HHH	MMM	MMM	HHH	MMM	LLL	MLL	LLL	LLL	LLL	MMM	LLL	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M161	WESTERN SPOTTED SKUNK	PPN	MLL	MMM	HHH	HHH	MMM	MMM	HHH	MMM	LLL	MLL	LLL	LLL	LLL	MMM	LLL	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M161	WESTERN SPOTTED SKUNK	RFR	LLL	LLL	LLL	HHH	MMM	LLL	LLL	MMM	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL			N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M162	STRIPED SKUNK	MCN	HLL	HMM	HHH	MMM	LMM	HMM	HHH	MMM	LLL	LMM	LMM	MMM	LLL	LLL	MLL	LLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M162	STRIPED SKUNK	PPN	HLL	HMM	HHH	MMM	LMM	HMM	HHH	MMM	LLL	LMM	LMM	MMM	LLL	LLL	MLL	LLL	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M162	STRIPED SKUNK	RFR	MLL	MLL	LLL	LLL	LMM	MLL	LLL	LLL	LLL	LMM	LMM	MMM	LLL	LLL	MLL	LLL	LLL	LLL	Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
M165	MOUNTAIN LION	MCN	L	HMM	HHH	MHH	MMM	HMM	HHH	MHH	LHH	HMM	HHH	MHH	MHH	MMM	LMM	LHH	LMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M165	MOUNTAIN LION	PPN	L	HMM	HMM	MHH	MHH	HMM	HMM	MHH	LHH	HLL	HMM	MHH	LHM	MMM	MMM	MHH	MMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M165	MOUNTAIN LION	RFR	L	LLL	LLL	MMM	MMM	LLL	MLM	MHH	LMM	LLL	LLL	MMM	LMM	LLL	LLL	MMM	LMM	MMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M166	BOBCAT	MCN	MLL	HHH	HHH	HHH	MMM	HHH	HHH	MMM	LMM	MHH	MMM	LMM	LLL	MMM	LMM	LLL	LLL	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M166	BOBCAT	PPN	MLL	HHH	HHH	HHH	MMM	HHH	HHH	MMM	LMM	MHH	MMM	LMM	LLL	MMM	LMM	LLL	LLL	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M166	BOBCAT	RFR	MLL	HHH	HMM	MMM	LLL	HHH	HMM	MMM	LLL	MMM	MLL	LLL	LLL	MLL	LLL	LLL	LLL	LMM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M176	WILD PIG	MCN	L	L	LLL	LLL	MMM	L	LLL	MMM	MLL	L	LLL	MMM	LLL	LLL	LLL	MMM	LLL	MMM	Y	Y				Y			Y	Y	Y	Y
M176	WILD PIG	PPN	L	L	LLL	LLL	MMM	L	LLL	MMM	MLL	L	LLL	MMM	LLL	LLL	LLL	MMM	LLL	MMM	Y	Y				Y			Y	Y	Y	Y
M177	ELK	MCN	HLH	HLH	HLH	HMH	MMM	HMH	HMH	MMM	M	MHM	MHM	LHM	L	MMM	LLL	L		L	Y	Y		Y			Y					
M181	MULE DEER	MCN	MLL	HHM	HHM	MMM	LLM	MHM	HHM	MMH	LLH	MMM	MMM	MHM	LLH	MMM	MMM	LMM	LLL	LLM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M181	MULE DEER	PPN	MLL	HHM	HHM	MMM	LLM	MMH	HHM	MMH	LLH	MMM	MMM	MMM	LLM	MMM	MMM	LLL	LLM	LLM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
M181	MULE DEER	RFR	MLL	HHM	HHM	MMM	LLM	MMH	HHM	MMH	LLH	MMM	MMM	MMM	LLM	MMM	MMM	LLL	LLM	LLM	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R004	WESTERN POND TURTLE	MCN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		N	N	Y			Y	Y	Y	Y	Y	Y	Y
R004	WESTERN POND TURTLE	PPN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		N	N	Y			Y	Y	Y	Y	Y	Y	Y
R022	WESTERN FENCE LIZARD	MCN	HHH	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R022	WESTERN FENCE LIZARD	PPN	HHH	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	HHH	HHH	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS SYSTEM
Database Version: 08/08/89
Ad Hoc Query by Donald Yasuda, Eldorado NF, Pacific RD

ID	NAME		1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6	STAGE		SEASON IN LOCATION									
			FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	FRC	YG	OG	ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
R023	SAGEBRUSH LIZARD	MCN	MMM	MMM	MMM			MMM	MMM			MMM	MMM			MMM	MMM				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R023	SAGEBRUSH LIZARD	PPN	MMM	MMM	MMM	MMM		MMM	MMM			MMM	MMM			MMM	MMM				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R029	COAST HORNED LIZARD	PPN	LLL	LLL	LLL	LLL		LLL	LLL			LLL	LLL			LLL	LLL				N	N	Y				Y				Y	Y
R031	SHORT-HORNED LIZARD	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N					Y					
R036	WESTERN SKINK	MCN	MMM	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y		Y		Y
R036	WESTERN SKINK	PPN	MMM	MMM	MMM	LLL	LLL	MMM	MMM	LLL	LLL	MMM	MMM	LLL		LLL	LLL	LLL			Y	N	Y	Y		Y	Y	Y		Y		Y
R037	GILBERT'S SKINK	PPN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y	Y					Y	Y	Y	Y
R039	WESTERN WHIPTAIL	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R040	SOUTHERN ALLIGATOR LIZARD	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	LLL	LLL	LLL	LLL	Y	N	Y	Y		Y		Y	Y	Y	Y	Y
R040	SOUTHERN ALLIGATOR LIZARD	PPN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
R042	NORTHERN ALLIGATOR LIZARD	MCN	HHH	HHH	HHH	HHH	MMM	HHH	HHH	HHH	MMM	HHH	HHH	HHH	LLL	HHH	HHH	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R042	NORTHERN ALLIGATOR LIZARD	PPN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R042	NORTHERN ALLIGATOR LIZARD	RFR	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	LLL	LLL	LLL	LLL	Y	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R046	RUBBER BOA	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R046	RUBBER BOA	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R046	RUBBER BOA	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R048	RINGNECK SNAKE	MCN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y			Y	Y	Y	Y	Y	Y	Y
R048	RINGNECK SNAKE	PPN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y			Y	Y	Y	Y	Y	Y	Y
R049	SHARP-TAILED SNAKE	MCN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y			Y		Y	Y	Y	Y	Y
R049	SHARP-TAILED SNAKE	PPN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y			Y		Y	Y	Y	Y	Y
R051	RACER	MCN	MMM	MMM	MMM	MMM		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R051	RACER	PPN	MMM	MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL		MMM	MMM	LLL			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R053	CALIFORNIA WHIPSNAKE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y		Y	Y	Y	Y	Y
R053	CALIFORNIA WHIPSNAKE	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y		Y	Y	Y	Y	Y
R057	GOPHER SNAKE	MCN	MMM	MMM	MMM	MMM		MMM	MMM	MMM		MMM	MMM	MMM		MMM	MMM	MMM			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R057	GOPHER SNAKE	PPN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM		MMM	MMM	MMM		MMM	MMM	MMM			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R058	COMMON KINGSNAKE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R058	COMMON KINGSNAKE	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R059	CALIFORNIA MOUNTAIN KINGSNAKE	MCN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y	Y	Y	Y	Y	Y	Y
R059	CALIFORNIA MOUNTAIN KINGSNAKE	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y			Y	Y	Y	Y	Y	Y	Y
R061	COMMON GARTER SNAKE	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LML		Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
R061	COMMON GARTER SNAKE	PPN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL		Y	Y	Y			Y	Y	Y	Y	Y	Y	Y
R062	WESTERN TERRESTRIAL GARTER SNAKE	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R062	WESTERN TERRESTRIAL GARTER SNAKE	PPN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R062	WESTERN TERRESTRIAL GARTER SNAKE	RFR	HHH	HHH	HHH	HHH	LLL	HHH	HHH	HHH	LLL	HHH	HHH	HHH	LLL	HHH	HHH	HHH	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R063	WESTERN AQUATIC GARTER SNAKE	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y

ID	NAME		1 FRC	2S FRC	2P FRC	2M FRC	2D FRC	3S FRC	3P FRC	3M FRC	3D FRC	4S FRC	4P FRC	4M FRC	4D FRC	5S FRC	5P FRC	5M FRC	5D FRC	6 FRC	STAGE YG	STAGE OG	SEASON IN LOCATION ELD	INY	LTB	LAS	MOD	PLU	SIE	STN	SEQ	TAH
R063	WESTERN AQUATIC GARTER SNAKE	PPN	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	MMM	LLL		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R071	NIGHT SNAKE	MCN	LLL	LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL		LLL	LLL	LLL			N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R071	NIGHT SNAKE	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL		N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y
R074	SPECKLED RATTLESNAKE	PPN	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL		N	N		Y				Y				
R076	WESTERN RATTLESNAKE	MCN	MMM	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	MMM	MMM	MMM	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R076	WESTERN RATTLESNAKE	PPN	HHH	HHH	HHH	HHH	LLL	HHH	HHH	HHH	LLL	HHH	HHH	HHH	LLL	HHH	HHH	HHH	LLL	LLL	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
R076	WESTERN RATTLESNAKE	RFR	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	LLL	N	N	Y	Y		Y	Y	Y	Y	Y	Y	Y

TOTAL SPECIES: 263

SPECIES IN ONLY YOUNG SERAL STAGES: 18
SPECIES IN ONLY OLD SERAL STAGES: 1
SPECIES IN BOTH SERAL STAGES: 146
SPECIES IN NEITHER SERAL STAGE: 98

} Based on M or H value for feeding, reproduction, or cover in each stage

Young seral stages defined as habitat stages 1 through 4D
Old seral stages defined as habitat stages 5S through 6

APPENDIX C

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BIOLOGICAL EVALUATION
of
CALIFORNIA SPOTTED OWL
INTERIM MANAGEMENT STRATEGIES

National Forests of the Sierra Nevada Province
Pacific Southwest Region (R5)

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I. INTRODUCTION

Maintaining viable populations of spotted owls has been a concern for the National Forests for the past decade. With the listing of the northern spotted owl, a management strategy was proposed by Thomas et al. (1990) that identified the current management strategy (SOHAs) as being incapable of maintaining viable populations of owls because of its tendency to isolate populations and not provide for their dispersal.

The current Pacific Southwest Region (R5) strategy of managing for the California spotted owl continues to be the SOHA system. With the release of the ISC report (Thomas et al. 1990), this strategy came under question. A multi-agency team was established to review the biology and management of the California spotted owl. The result of this effort was documented in the California Spotted Owl Technical Report (Verner et. al. 1992) which also concluded that the SOHA strategy for managing spotted owls would not maintain long term viability of the species.

The objective of this environmental assessment is to review alternative management strategies for interim guidelines for the California spotted owl that will maintain viability of the species while longer term guidelines are developed. Selection of any of the three alternatives will not affect current direction for other species found in the Regional Guide, Forest Land and Resource Management Plans or species Recovery Plans. All current direction and analysis and consultation processes designed to maintain other threatened, endangered, sensitive or proposed species (TESP) will remain in effect. Projects will follow the standards and guidelines developed during the NEPA process for Forest Land and Resource Management Plans (LRMPs). Standards and guidelines included in LRMPs are designed to ensure maintenance of habitat at a level that will retain species and their habitats.

Selection of any of the three alternatives does not require that any project activity take place. If proposed, future timber management projects on any of the Sierra Nevada forests must meet the guidelines of the selected alternative, as a minimum, to maintain viability of the owl. Project-specific biological evaluations will evaluate the needs of threatened, endangered, sensitive or proposed species and will recommend appropriate actions where the guidelines are found to conflict with the needs of other species.

This biological evaluation (BE) addresses the need for site-specific evaluations of projects within California spotted owl habitat. Site-specific biological evaluations will be required for all projects on National Forest System lands within the Sierran province. Due to the extremely localized nature of wildlife, fish and sensitive plant occurrences throughout the Sierra Nevada, determination of effects can best be made at the project level. Therefore, this document can serve only as a foundation for project level BEs. This BE also provides a process by which timber management activities can be designed to achieve determinations of "no impact" or "may impact individuals but not likely to result in a trend toward Federal listing or a loss of viability."

The choice of an alternative in this document will have no effect on any threatened, endangered or proposed species and therefore, consultation with the United States Fish and Wildlife Service (USFWS) is not required. However, consultation will be initiated with the USFWS if a site-specific BE results in a 'may affect' determination.

II. CURRENT MANAGEMENT DIRECTION

Current management direction for desired future conditions for threatened, endangered, and sensitive species in the Sierra Nevada Province can be found in:

- Forest Service Manual and Handbooks (FSM/H 2670and 1950)
- National Forest Management Act (NFMA)
- Endangered Species Act (ESA)
- National Environmental Policy Act (NEPA)
- Individual Forest Land and Resource Management Plans (LRMP) and supplemented LRMP agreements (Sequoia Mediated Settlement Agreement {MSA})
- Forest Multiple Use plans
- Species specific Recovery Plans which establish population goals for recovery of those species
- Species management plans
- Species management guides or conservation strategies
- Regional Forester policy and management direction

The management direction sections are a compilation of the standards and guidelines in LRMPs and the Sequoia MSA, scientific literature on each species, and the expertise of 15 of the Region's biologists. This direction is not intended to replace or reduce project specific design or analysis on individual forests.

Applicable policy, as shown in the Forest Service Manual (FSM 2671.45), is to conduct a prefield review of available information, and in instances where there is no evidence of species or habitat, "document the findings of the biological evaluation in the decision notice when an environmental assessment has been prepared (FSM 1950). If an action is excluded categorically from preparation of an EA or EIS, document the findings in the unit files and proceed with the proposal."

Forest Service policy for sensitive species stated in the Forest Service Manual (FSM 2670.32) includes the following:

1. Avoid or minimize impacts to species whose viability has been identified as a concern.

2. If impacts cannot be avoided, analyze the significance of the potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.

3. Establish management objectives for Federal candidate species.

Management direction for individual animal species listed in the next section may be found in Appendix B of the Biological Evaluation for Drought-Related Timber Salvage on National Forests of the Sierra Nevada Province (US Forest Service 1992).

III. THREATENED, ENDANGERED AND FOREST SERVICE SENSITIVE (TES) SPECIES

Forest Service direction for federally listed species is to manage National Forest System habitats to achieve recovery objectives so that special protection measures provided under the Endangered Species Act (ESA) are no longer necessary.

Federally listed endangered and threatened wildlife, fish and plant species which may be expected to occur in the National Forests of the Sierra Nevada considered in this document are:

California condor (Gymnogyps californianus)	Endangered
Bald eagle (Haliaeetus leucocephalus)	Endangered
American peregrine falcon (Falco peregrinus anatum)	Endangered
Shortnose sucker (Chamistes brevirostrus)	Endangered
Lost River sucker (Deltistes laxatus)	Endangered
Modoc sucker (Catostomus microps)	Endangered
Truckee barberry (Mahonia sonnei)	Endangered
Northern spotted owl (Strix occidentalis caurina)	Threatened
Little Kern golden trout (Oncorhynchus aguabonita whitei)	Threatened
Paiute cutthroat trout (Oncorhynchus clarki seleniris)	Threatened
Lahonton cutthroat trout (Oncorhynchus clarki henshawi)	Threatened
Shasta crayfish (Pacifastacus fortis)	Threatened
VELB* (Desmocerus californicus dimorphus)	Threatened
Kern primrose sphinx moth (Euproserpinus euterpe)	Threatened

* valley elderberry longhorn beetle

Region 5 Forest Service Sensitive wildlife, fish and plant species considered in this document are:

California spotted owl (Strix occidentalis occidentalis)
Great gray owl (Strix nebulosa)
Willow flycatcher (Empidonax traillii)
Fisher (Martes pennanti)
Marten (Martes americana)
Sierra Nevada red fox (Vulpes vulpes necator)
Northern goshawk (Accipter gentilis)
Allium tribracteatum
Allium yosemitense
Antennaria flagellaris
Arabis constancei
Arabis rigidissima var. demota
Asplenium septentrionale
Astragalus lentiformis
Astragalus webberi
Calochortus clavatus var. avius
Calochortus longibarbatus
Calochortus westonii
Camissonia sierrae ssp. alticola
Campanula wilkinsiana
Carpenteria californica
Clarkia australis
Collomia debilis var. larsenii
Collomia rawsoniani

Erigeron multiceps
Eriogonum prattenianum var. avium
Eriogonum prociduum
Eriogonum twisselmanii
Eriogonum umbellatum var. torreyanum
Eriophyllum congdonii
Eriophyllum nubigenum
Erythronium pluriflorum
Erythronium tuolumnense
Fritillaria eastwoodiae
Galium glabrescens ssp. modocense
Galium serpenticum ssp. warnerense
Gratiola heterosepala
Horkelia tularensis
Ivesia aperta
Ivesia baileyi
Ivesia paniculata
Ivesia sericoleuca
Ivesia unguiculata
Ivesia webberi
Lewisia cantelowii
Lewisia congdonii
Lewisia serrata
Lupinus citrinus
Lupinus dalesae
Mimulus filicaulis
Mimulus pygmaeus
Monardella stebbinsii
Orcuttia tenuis
Navarretia prolifera ssp. lutea
Nemacladus twisselmanii
Oreonana purpurascens
Penstemon personatus
Phacelia stebbinsii
Raillardiopsis muirii
Sedum albomarginatum
Senecio eurycephalus var. lewisrosei
Silene invisa
Trifolium bolanderi
Trillium ovatum ssp. oettingeri
Vaccinium coccinium

To the extent practical in a programmatic BE, accounts for TES animals are incorporated by reference from the Sierra Nevada Salvage BE (USDA Forest Service 1992). Detailed descriptions of historical information, reproductive success, recent survey efforts, and relative distributions of the species in any proposed project areas must be provided with field analysis to supplement the outlined programmatic review of this EA. Similarly, descriptions of habitat quality, quantity, and configuration must also be provided at the project level. Discussions of this nature are well beyond the scope of this document and need to be prepared in response to specific projects.

TES species exist in a dynamic environment, and accurate descriptions of life history, habitat status and distribution will vary from descriptions provided in the 1992 salvage BE. This is due to the effects of management activities such as logging and road building, as well as natural stochastic events such as fire and continued mortality in many stands of conifers. Line officers need accurate assessments of the status of TES species in proposed project areas in order to ensure that all TES species receive full consideration in the decision making process (FSM 2672.41). This type of information is best provided by project specific BEs.

IV. CONSULTATION WITH U.S. FISH AND WILDLIFE SERVICE (USFWS)

As required in 50 CFR 402.12(c), each forest must request a list of threatened and endangered species from the USFWS in order to determine the affects of a proposed action on those species. The following forests requested species lists and received reply as listed below. We received the USFWS information on July 29, 1992 and the species list was utilized as part of the biological evaluation. The USFWS correspondence may be found in the planning files.

	USFWS Reply Date
Eldorado National Forest	July 29, 1992
Lassen National Forest	July 29, 1992
Modoc National Forest	July 29, 1992
Plumas National Forest	July 29, 1992
Sequoia National Forest	July 29, 1992
Sierra National Forest	July 29, 1992
Stanislaus National Forest	July 29, 1992
Tahoe National Forest	July 29, 1992
Lake Tahoe Basin	July 29, 1992

V. DESCRIPTION OF THE PROPOSED ALTERNATIVES

A description of the three proposed alternatives for the interim management of California spotted owl habitat in R5 is available in Section III - Alternatives' of the Environmental Assessment for The Sierran Province of the California Spotted Owl: Interim Guidelines (U.S. Forest Service 1992a).

In summary:

ALTERNATIVE 1 (NO ACTION)

No action would maintain the current spotted owl habitat area (SOHA) network strategy as described in the Regional Guide for the Pacific Southwest Region (40 CFR 1506.4). These networks have been described, delineated and analyzed. They are subject to management as enumerated in the LRMP of each National Forest.

ALTERNATIVE 2 (TECHNICAL TEAM RECOMMENDATIONS - CASPO)

This alternative proposes implementation of the recommendations of the California Spotted Owl Technical Assessment Team, released as the draft CASPO Report on May 8, 1992, and as a revised draft report on September 15, 1992. Designed to meet objectives stated in the final CASPO Report, this alternative would maintain future management options by retaining stand components most at risk and difficult to replace (i.e.

very large, old trees throughout Sierra Nevada coniferous forests). It protects known spotted owl nest/roost stands.

ALTERNATIVE 3 - (CUMULATIVE EFFECTS ANALYSIS [CEA] PROCESS)

The CEA process has been in use since July 1991. This alternative proposes continued implementation of the process, with modifications made to incorporate new information presented in the CASPO Report. This alternative would maintain a full range of options for managing spotted owls in the future by maintaining habitat needed to support the existing owl population. It is a project-driven analysis process, which evaluates the potential effects of a proposed project upon spotted owls. Necessary adjustments are made to projects to ensure that the proposed action will not reduce or degrade the total suitable owl habitat below levels needed to support the current estimated number of owls in the analysis area.

VI. EXISTING LANDSCAPE ENVIRONMENT IN THE SIERRA NEVADA RANGE

CLIMATE

West of the Sierra crest, weather is primarily of a Mediterranean pattern with wet winters and dry summers. East of the crest, the influence of the Pacific Ocean decreases and there is a greater range in daily and seasonal temperatures, lower precipitation amounts, a greater contribution of precipitation from summer thunderstorms, and lower humidity. Snowpack is common at elevations above 5,000 feet in the north to 7,000 feet in the south, November through May. Generally, the total amount of precipitation decreases as one travels further south or east of the topographic crest.

From an ecological perspective, periods of drought can be viewed as a "normal" part of long-term fluctuating weather patterns and can be expected to occur in the future. In the past 50 years, droughts have occurred from 1946-50, 1952-55, 1958-62, 1975-1977, and 1986 to the present. Increased tree mortality has been associated with past droughts. While this climatological mortality can negatively impact individual and agency management objectives, it should not result in major widespread ecosystem-level changes in vegetative structure and diversity. In fact, such periodic droughts may provide natural snag and downed log cycling over the landscape.

GEOLOGY

The Sierra Nevada is a fault-block mountain range formed by faulting and uplifting. The range is geologically complex. Generally, National Forest lands range from 1,500 feet in elevation in the foothills to 14,242 feet at the highest peak.

Underlying most of the Sierra Nevada are the granitic rocks of the Sierra Nevada batholith. Granite is the most common rock type, being especially evident at the higher elevations. Volcanic rocks once covered much of the entire range which has eroded extensively and are represented by old extrusive lava flows. Lower elevations to the west are where metamorphic rocks are generally evident. Eleven major rivers, plus numerous smaller watersheds drain the Sierra Nevada into the central Valley of California. These include the Feather, Merced, Yuba, American, Mokelumne, Stanislaus, Tuolumne, Kings, Kaweah, Tule, and Kern Rivers.

The west slope is a relatively gentle transition from the Central Valley to the crest. Typically, the eastern slope is a sharp, often precipitous elevation change from the crest to the Great Basin.

Parts of the Plumas and Lassen National Forests encompass parts of the Klamath geologic province. The Modoc National Forest encompasses part of the Modoc Plateau and the southern half of the Warner Mountains.

VEGETATION

Vegetation in the Sierra Nevada and those portions of the Klamath province and Modoc Plateau included in this analysis is quite diverse. Differences in elevation, aspect, slope, soil development, parent material, precipitation, and latitude combine to form a mosaic of plant communities. Coniferous forests are generally the dominant vegetative type on National Forest lands.

HISTORY AND CURRENT CONDITION OF SIERRA NEVADA FORESTS

The project EA provides an excellent overview of Sierran forests and the factors that have shaped them in Section IV-Affected Environment and Environmental Effects - Timber section (USDA Forest Service 1992b).

Subpart A

ANIMALS

A.I. INTRODUCTION TO THE ANIMAL SECTION

This document provides physiographic province (Sierra Nevada) level coordination of biological evaluation methodology and mitigation measures for projects implemented under any of the three proposed interim strategies for the management of California spotted owls. The programmatic biological evaluation (BE) does not relieve the Forest Service (FS) of the requirement to conduct site-specific project analyses. Consequently, a site-specific BE, whether brief or lengthy, must be prepared for each proposed project.

The Sierra Nevada Province is defined as the National Forest System lands that extend from the Modoc National Forest in the north to the Sequoia National Forest in the south.

1. FEDERALLY LISTED THREATENED, ENDANGERED, AND PROPOSED ANIMAL SPECIES IN THE SIERRA NEVADA PROVINCE

Federally listed threatened, endangered or proposed animal species which may be expected to occur in the National Forests of the Sierra Nevada considered in this document are:

California condor (Gymnogyps californianus)	Endangered
Bald eagle (Haliaeetus leucocephalus)	Endangered
American peregrine falcon (Falco peregrinus anatum)	Endangered
Shortnose sucker (Chamistes brevirostrus)	Endangered
Lost River sucker (Deltistes laxatus)	Endangered
Modoc sucker (Catostomus microps)	Endangered
Little Kern golden trout (Oncorhynchus aguabonita whitei)	Threatened
Paiute cutthroat trout (Oncorhynchus clarki seleniris)	Threatened
Lahonton cutthroat trout (Oncorhynchus clarki henshawi)	Threatened
Shasta crayfish (Pacifastacus fortis)	Threatened
VELB* (Desmocerus californicus dimorphus)	Threatened
Kern primrose sphinx moth (Euproserpinus euterpe)	Threatened
Northern spotted owl (Strix occidentalis caurina)	Threatened

* valley elderberry longhorn beetle

2. SENSITIVE ANIMAL SPECIES ON NFS LANDS IN THE SIERRA NEVADA PROVINCE

Region 5 Forest Service sensitive wildlife and fish species considered in this document are:

California spotted owl (Strix occidentalis occidentalis)
Great gray owl (Strix nebulosa)
Willow flycatcher (Empidonax traillii)
Fisher (Martes pennanti)
Marten (Martes americana)
Sierra Nevada red fox (Vulpes vulpes necator)
Northern goshawk (Accipter gentilis)

A.II. EXISTING ENVIRONMENT - RANGE, DISTRIBUTION AND SUITABLE HABITAT

Descriptions of suitable habitats are based on review of literature, field observations, discussions with species specialists and aids such as timber inventory, soil maps, vegetation maps, topographic maps, and aerial photographs.

Section IV of the accompanying environmental assessment - Affected Environment and Environmental Effects - provides a description of the habitat requirements and population status of the California spotted owl, and a detailed discussion of the effects of the alternatives upon the owl within the Sierra Nevada province. The reader should refer to this section of the EA for information on the California spotted owl.

The reader is referred to the Existing Environment section of the Biological Evaluation for Drought-Related Timber Salvage on National Forests of the Sierra Nevada Province (U.S. Forest Service 1992) for discussions of all other TESP species covered in this document, excepting the Northern spotted owl. A discussion of the Northern spotted owl existing environment is available in the Existing Environment section of the Biological Evaluation for Drought-Related Timber Salvage on National Forests of the Klamath Province (USDA Forest Service 1992).

A.III. OVERLAP WITH CALIFORNIA SPOTTED OWL REQUIREMENTS AND GENERAL EFFECTS

CALIFORNIA CONDOR

The habitat requirements of the California condor overlap with those of the California spotted owl in that both require large diameter conifers and snags. However, the condor utilizes a variety of seral stages and requires vast expanses of open savannah, grasslands, and foothill chaparral for foraging and cliffs for nesting (Zeiner et al. 1990). Currently, the only condors in the wild are found on the Los Padres National Forest and are therefore not affected by the decision of this Environmental Assessment.

Potential future effects on the California condor from potential timber management activities consist of modification or loss of habitat or habitat components. Although the seven condors in the wild have currently made only short exploratory flights from their release site on the Los Padres National Forest, it is possible that the newly released condors will continue to make longer and longer forays as they become familiar with their new environment. In the long term, there is the possibility for rediscovery of the historic sites on the Sequoia National Forest. Important habitats or habitat elements are: caves, crevices, potholes along cliffs, and large diameter conifer trees with large cavities for nesting; grasslands and oak-savannah habitats for feeding; and large coniferous trees, snags, and cliffs primarily in areas on the upper two-thirds of the slope and with thermal updrafts for roosting.

Additional potential effects are possible behavioral disturbance to nesting condors from logging, road-building, or other associated activities within occupied habitat, which could prevent nesting or lead to nest failure (California Condor Recovery Plan 1984). Little information is available in the literature regarding the effects of human-related disturbance on the condor. Condors may be sensitive to human presence, which may discourage them from nesting or roosting in otherwise suitable habitat (Ibid).

The effect of vegetation management on the probability of wildfire is another ramification of potential management. Vegetation management which decreases the probability of wildfire could have a beneficial effect on the condor by decreasing the probability of catastrophic wildfire destroying potential or existing habitat. Fuels management that utilizes controlled burning may improve condor foraging habitat in addition to reducing the chance of catastrophic fire (California Condor Recovery Plan 1984).

BALD EAGLE

The bald eagle shares habitat needs with the California spotted owl in terms of the nesting requirement for stands with old forest components such as large diameter green trees. The bald eagle differs from the owl in that all successional stages are used for activities other than nesting to some extent (Verner and Boss 1980).

Bald eagles may nest in forest edge habitats if suitable old forest components (large diameter snags and live trees) are present (Postovit and Postovit 1987). Long timber rotations are most favorable. Management for long rotations allows forested areas to support both early and late successional stage nesting species in turn (Reynolds et al. 1982).

Harvest of timber can potentially affect bald eagle use of habitat by removing suitable foraging perches or nest groves. Winter roosts on margins of lakes and bodies of water can also be degraded by removal of resting sites. Use of noisy machinery within one half mile of a nest during breeding season can disrupt the reproductive effort.

Since wintering bald eagles, in particular, rely on waterfowl as a dietary staple, any management activities that disrupt the hydrology of wetlands, lakes or riparian areas could have direct effects on eagles. An example of a potentially disruptive factor would be to lower water levels (which would affect capacity for fish production as well as the attractiveness to migratory waterfowl).

If habitat is modified or lost, or a disturbance that disrupts behavioral activities causes displacement of the eagle from a site, it is likely to shift its range to adjacent eagle territories. This results in a phenomena known as 'packing'. As described in the Interagency Scientific Committee Report on the conservation of the Northern spotted owl (Thomas et al. 1990), packing occurs when individuals temporarily escape from a place where habitat is being degraded or destroyed. They move into nearby patches of undisturbed habitat. These undisturbed habitats generally exhibit an increased density of individuals in the period immediately following the disturbance. Given the limited resources on any one site, intra-specific competition increases and the displaced individuals are not able to persist there indefinitely.

The result of packing is an apparent increased density in patches of habitat that remain suitable for the species. This is a false impression, since the actual explanation for the occurrence is packing by a species whose population may otherwise be declining due to habitat loss (Thomas et al. 1990). The potential for misinterpretation of data collected in areas where packing is a factor highlights the need to assess effects to populations on as large a geographic scale as possible (Ibid).

AMERICAN PEREGRINE FALCON

Peregrines are known to forage near and occasionally within forested habitat types; however, forests are not considered required habitat for any stage of their life history. Riparian and wetland areas are important due to avian prey species occurrence in greater abundances than would be predicted based upon the surrounding vegetation. Vertical cliffs near a lake or river are key habitat sites and should be provided extra management attention.

The only area of overlap with the habitat requirements of the California spotted owl is in the requirements of some prey species. Band tailed pigeons use dense, multi-storied stands and woodpeckers are dependent upon the presence of snags in the habitat. These are major prey species of peregrine falcon in the Sierra Nevada mountains of California.

THREATENED AND ENDANGERED FISH

Timber harvest activities can affect threatened and endangered fish species and their habitats. Potentially, the primary indirect effects of timber harvest activities could be the loss of large woody debris (LWD) to the channel and riparian area. LWD plays an integral role in the structure and function of the channel and floodplain. Loss of LWD could: reduce the morphological diversity of the channel (fewer pools), impact the trophic and functional group structure of the invertebrates fed upon, have a negative impact on channel stability, and lead to increased sedimentation of channels. These effects would all decrease the habitat quality. The intensity of the effects is difficult to predict. Reduction of LWD recruitment could have a high to

moderate impact depending on site specific conditions. The impact would persist at least as long as it would take to grow trees of equal height and diameter on the site.

Other indirect effects of potential timber harvest activities could result from the reconstruction or continued use of roads and landings. Roads and landings can be a major source of sediment to streams. Especially detrimental are those roads, landings, and skid trails currently located within riparian areas. Concentrated runoff from roads and sediment transport from roads, cut and fill slopes, and landings increases the amount of sediment in the streams and decreases the habitat quality. The intensity of the effect can range from high to low depending on soil types, maintenance of erosion control structures, road surface treatment, slope and design.

Harvest activities may be conducted during winter months by helicopter, cable or tractor methods. Winter logging poses many specific problems related to roads and landings. It is extremely important that Best Management Practices (BMPs) be implemented to protect water quality during winter harvest. Operators/ contractors must be aware that extra requirements and expectations will need to be met during wet weather operation to protect water quality.

A third potential indirect effect of timber management activities is the use of water for dust abatement. California is in the midst of a 6 year drought and the creeks in the Sierra Nevada are at critically low levels. Drafting water from creeks during the summer months could have a negative impact on all water-dependent species. The intensity of the effect could be high. The actual duration of the impact would be short (time it takes to draft water), but the effect could be long lasting if a creek were de-watered.

Fuels treatments after harvest may also affect threatened or endangered (T&E) fish. Lop and scatter techniques could provide more ground cover to reduce sedimentation to the streams if the slash depth did not exceed 18 inches (fire hazard). Biomass treatments could have a detrimental impact if most of the ground cover were removed from the site. Maintaining a depth of approximately 18 inches is desirable. Properly executed burns should not adversely affect stream habitat.

Spatial Effects

Private land holdings may occur within watersheds which harbor Modoc sucker and Lahontan cutthroat trout. Timber harvest activities on private land could potentially affect the habitat of any of the T&E fish species. Traditionally, private lands are entered fairly frequently for timber harvest. Considering the current market, salvage opportunities, and decline of timber harvest on public lands, we can anticipate that harvest from private lands will continue at historical or higher levels. The magnitude and nature of this effect is impossible to predict.

Temporal Effects

It is highly likely that channel morphology has changed over time in response to a variety of natural and man-made disturbances. Activities in the watershed, such as timber harvest, can lead to cumulative watershed effects. These issues need to be addressed in site specific Environmental Analyses, Cumulative Watershed Effects Analyses, and Biological Evaluations.

Timber has been harvested since the late 1880s on lands which are now managed by the Forest Service. Early harvest operations and operations through the 1970s often did not provide protection to riparian areas. As a consequence, many riparian areas have been disturbed and do not represent natural or stable conditions. LWD levels are reduced and green tree stocking of the riparian areas may be less than natural pre-disturbance levels.

In the past, roads, skid trails and landings were often constructed in riparian areas. The impact of these compacted, non-vegetated sites continue long past their inception. Many of these sites were never put to bed properly and they continue to degrade the quality of the riparian habitat.

When standing dead timber is left within a riparian area, this material can provide a pulse of LWD to the riparian area. This material would provide a wide range of benefits, including habitat for a variety of amphibians, reptiles, and invertebrates (both terrestrial and aquatic), sediment and nutrient retention in the riparian area, channel stability, creation of pools, and cover for fish. If salvage trees are harvested within the riparian area, these benefits are lost.

If old roads and landings are used for harvest operations, more sediment could potentially enter the channels from harvest activities. The opportunity should exist to close and rehabilitate these areas within the riparian zones. The roads and landings could be ripped planted, and blocked so that these areas could recover.

SHORTNOSE AND LOST RIVER SUCKERS

The habitat requirements of the shortnose and Lost River suckers are not well known, but do not overlap with habitat requirements of the California spotted owl.

Important habitat components are long stretches of inflowing rivers for spawning, lake habitats for feeding and resting, and good water quality in these two habitats. Activities that could affect these species are ones that affect water quality by increasing the amount of sediment input into streams and/or lakes.

Population decreases seem to be primarily related to decreasing spawning habitat due to damming of historical spawning areas and associated problems (Federal Register 53 [137]:27130-27134) and six years of drought.

MODOC SUCKER

Habitat requirements for the Modoc sucker do not overlap with those of the California spotted owl, except that coarse woody debris appears to be important to both species. Coarse woody debris in streams provide cover for the Modoc sucker.

This species is found in muddy-bottom pools with cool, moderately clear water (Moyle 1974). The Modoc sucker utilizes toe-logs and tips of the juniper revetment and coarse woody debris in streams for cover. Important habitat components, therefore, include the shading of streams by vegetation, coarse woody debris, and good water quality.

The Modoc sucker has been extirpated from a significant portion of its naturally limited range due to habitat loss from overgrazing, siltation, and channelization (Federal Register 50[112]:24526-24530). In addition, the current drought has increased the number of creeks which become intermittent during the summer.

LITTLE KERN GOLDEN TROUT

The Little Kern golden trout has some overlap with habitat requirements of the California spotted owl. Cool microclimates are important to both species, as are snags, coarse woody debris (CWD) and canopy cover, especially in riparian areas.

Only three fingers of the metapopulation occur outside the Little Kern Golden Trout Wilderness. They are in the headwaters of streams. Headwaters are extremely critical to the overall stream condition and structure, particularly with respect to sediment loading and water temperature.

PAIUTE CUTTHROAT TROUT

The proposed alternatives for management of California spotted owls would have "no effect" on the Paiute cutthroat trout or its habitat, provided site specific analysis at the project level assesses and mitigates specific proposed management actions.

The Paiute cutthroat trout has some overlap with habitat requirements of the California spotted owl. Cool microclimates are important to both species, as are snags, CWD and canopy cover, especially in riparian areas.

Adults prefer low gradient meadow reaches of the stream in this species with a very restricted distribution. Within the range of this trout, it is very important to consider maintaining or enhancing riparian areas. Where meadows containing or adjacent to riparian areas occur, a buffer around the meadow would also serve to limit sedimentation and maintain canopy cover, understory and stream shading.

LAHONTAN CUTTHROAT TROUT

The proposed alternatives for management of California spotted owls would have "no effect" on the Lahontan cutthroat trout or its habitat, provided site specific analysis at the project level assesses and mitigates specific management actions.

The Lahontan cutthroat trout has some overlap with habitat requirements of the California spotted owl. Cool microclimates are important to both species, as are snags, CWD and canopy cover, especially in riparian areas.

It is important to maintain physical barriers separating the Lahontan cutthroat from other trout species. They interbreed and lose genetic purity/integrity. They are also outcompeted for scarce resources by introduced trout species. A 1:1 pool:riffle ratio is the ideal condition for this native trout species.

SHASTA CRAYFISH

The habitat needs of the Shasta crayfish are coincident with those of the California spotted owl in two respects. First, cover is important, to the crayfish for stream temperature and the owl for microclimate. Second, ground cover to reduce sedimentation for the crayfish and to provide prey habitat and microclimates for the spotted owl is also important.

Threats to this species include competition for food and space with introduced exotic crayfish, agricultural development (pesticides and herbicides), aquatic habitat loss due to water diversion or impoundment projects, and residential/recreational developments. Stream runs appear to be preferred over stream pools. The Shasta crayfish is particularly vulnerable to habitat loss or modification due to its life history characters: low fecundity, slow maturity, limited distribution and narrow, specialized habitat requirements.

The Federal Register (1988) notes that detrimental habitat impacts would include (1) substrate changes from rubble to mud resulting from siltation and the concomitant increase in aquatic vegetation, favoring the exotic crayfish, (2) deviations from preferred water quality parameters, (3) water pollution by agricultural runoff and (4) use of habitat for recreational purposes. Threats from recreation include siltation resulting from off road vehicle use and collection, as their placid behavior renders them vulnerable to this threat.

VALLEY ELDERBERRY LONGHORN BEETLE

This species has few habitat requirements in common with the California spotted owl. Flooding or mud slides, were they to occur, could further the loss of plant species used for feeding or breeding and constitute an indirect effect on this beetle. Application of Best Management Practices (BMPs) by each Forest in the upper

portions of watersheds draining into lowland valleys would mitigate any potential indirect effects to the valley elderberry longhorn beetle. These BMPs are designed to prevent flooding or mass movement of mud downstream from sites of project operation.

KERN PRIMROSE SPHINX MOTH

The sphinx moth prefers open, cultivated fields (especially barley fields) as habitat. It occupies lands adjacent to the Sequoia National Forest and its habitat does not overlap that of the California spotted owl. Any effects would be indirect.

Flooding or mud slides, were they to occur, could further the loss of plant species used for feeding or breeding and constitute an indirect effect on this moth. Application of Best Management Practices (BMPs) by each Forest in the upper portions of watersheds draining into Walker Basin would mitigate any potential indirect effects to the Kern primrose sphinx moth. These BMPs are designed to prevent flooding or mass movement of mud downstream from sites of project operation.

NORTHERN SPOTTED OWL

This species is geographically separated from the California spotted owl. The area of separation occurs roughly where Highway 299 crosses the Lassen National Forest. Additionally, the 1992 Fountain fire destroyed habitat along this highway and potentially increased the area of separation. This proposed action does not apply to habitat within the northern spotted owl range. Therefore it is not likely that management for the California spotted owl will affect the northern spotted owl.

CALIFORNIA SPOTTED OWL

Refer to the Environmental Assessment, Section IV-Affected Environment, Environmental Effects, for analysis of the California spotted owl.

GREAT GRAY OWL

The nesting habitat requirements for the great gray owl are very similar to those of the California spotted owl. Both require large diameter trees or snags for nesting, fairly closed canopies, and some degree of decadence in the stand. However, great gray owls require this habitat adjacent to meadow areas. Generally, the effects of potential timber management activities to nesting habitat are limited to forested areas adjacent to meadows or meadow complexes 25 acres or greater in size, and within 200 yards of the meadow edge.

Potential negative effects on the great gray owl from proposed timber management are primarily associated with the loss or modification of habitat or habitat components. Important habitats and habitat components are late-seral-stage forests adjacent to meadows, productive meadows with abundant rodent populations, the presence of large diameter snags, a shaded canopy, and the presence of down, leaning, and deformed trees. The latter are necessary for the young to safely move about after fledging but before they are able to fly. Management activities affected by the proposed alternatives are not expected to affect meadow habitat, but could affect other habitat components. This is especially true of nest snags. Generally, nest sites consist of snags which have broken in such as way as to produce a concave area on top of the standing bole. It takes a great many snags to produce one suitable nest snag.

Management activities can also cause direct disturbance to nesting great gray owls, potentially causing abandonment of nests or decreased nesting success. The spatial distribution of existing or potential great gray owl habitat can be affected by potential management activities. Decreases in habitat across the landscape can decrease the number of owls the landscape can potentially support, and increase habitat fragmentation, with associated effects such as increased edge, loss of microclimate, and increased chance of the "packing" phenomenon, decreased likelihood of individuals finding mates, and decreased likelihood

of young successfully dispersing. Potential effects need to be analyzed on a site specific basis through a project level BE.

WILLOW FLYCATCHER

The habitat needs of the willow flycatcher do not overlap with those of the California spotted owl. Important habitat and habitat components are wet meadows with large patches of riparian deciduous shrubs. Willow flycatchers require meadows which are wet during the nesting season of June and July, possibly due to the associated increased presence of their aerial insect prey.

The willow flycatcher should not be directly affected by potential timber management activities, since timber harvest and associated activities will not occur in meadows. However, upslope activities such as timber harvest, construction of roads and landings, and skid trails can disrupt the surface and subsurface flows of water. This, in turn, can cause drying of downslope meadow areas and could have a negative effect on the willow flycatcher.

Potential negative effects on surface or subsurface water flow may be obviated through the site-specific NEPA process, project design, and implementation of specifically developed mitigation measures.

MARTEN

Allen (1987) suggests the following four management considerations for both marten and fisher: (1) Maintain a high degree of interspersion between intensively managed stands and those of sufficiently long rotation to provide structural and vegetative diversity similar to old growth; (2) ensure snag availability; (3) maintain vegetation in riparian zones and ridgelines as dispersal habitat; and (4) maintain large woody debris/downfall. These four items will provide the basis for this analysis of effects.

1. Diversity. The structural diversity of forest vegetation provides the key to furbearer habitat quality (Ibid). Small open areas and regenerating stands (or plantations) are used by both fisher and marten as foraging habitat. These openings are of optimum value when they occur adjacent to mature forest stands meeting requirements for denning and/or resting habitat. Thus, all habitat requirements may be met within the smallest possible home range. This is roughly equivalent to high capability areas as defined by Freel (1991): habitat that supports stable populations of marten and/or fisher where the landscape is essentially saturated with home ranges, suggesting high prey densities and abundance of other selected habitat characteristics.

   At less than optimum, or moderate capability habitat, the landscape supports a stable population of marten and/or fisher where home ranges occur in lower densities than in high capability habitat, with lesser availability of preferred habitat characteristics and lower prey densities (Ibid).

   Landscape structural and vegetative diversity has historically been provided by fire. In natural situations where human intervention via fire suppression has not resulted in unnaturally high accumulation of fuels, fires burn in a mosaic pattern rather than extensive areas of firestorm devastation. Marten evolved in such ecosystems where fire has been the primary agent of vegetative diversity (Koehler et al. 1975). Both fisher and marten were virtually absent from extensive burned over areas, possibly due to lack of cover, food and denning opportunities (de Vos 1951). Failure to treat the accumulated standing dead as well as downed timber over extensive acreages in California could result in extensive, intense fires that would destroy many contiguous acres of habitat, fragment the remaining suitable habitat and isolate furbearer populations by eliminating dispersal corridors. Therefore, the proposed harvest alternatives focused on reducing fuel ladders may maintain furbearer habitat in the long term.

   If a relatively low intensity fire (leaving fuels >3" diameter) could be ensured on 1-2 acre patch sizes, broadcast burning might be helpful not only in reducing future fire hazard but in stimulating growth

of understory that favors marten prey species in areas adjacent to mature/old growth forest. This would enhance vegetative diversity.

2. Snag availability. Maintain large snags well-distributed across the landscape.

3. Dispersal cover. Maintain riparian and ridgeline vegetation.

4. Large woody debris. Stumps, blowdowns and other large woody debris provide points of access to the subnivean (or below snow surface) zone for hunting in winter (Bateman 1986). This subnivean zone is the marten's source of prey during winter, the most stressful season in terms of bioenergetics. Also, these sites may be used as resting areas by marten.

PACIFIC FISHER

Although the discussion of effects for marten (see previous section) is also applicable to fisher, there are several potential effects that appear to be unique to fisher. Fisher inhabit relatively mesic (moist) areas. Harvest operations that open the insulating canopy expose the site to the desicating effects of wind, resulting in a more xeric (dry) site (Buck et al. 1983).

For all furbearers, post-natal survival of young is a major determinant of annual recruitment to the population (Clark and Fritzell 1992). This has an important behavioral implication with regard to habitat fragmentation. Buck (1983) presented a plausible hypothesis. As habitat becomes fragmented or quality deteriorates (by harvest or natural processes), adult male fishers, being the largest and strongest individuals, outcompete females and juveniles for the remaining habitat. Intraspecific crowding pressures result to the female proportion of the population. Also, as juveniles disperse, a greater chance of agonistic encounters with conspecifics results and increases juvenile mortality (with the effect of decreasing recruitment to the next generation). Fisher appear to be sensitive to habitat fragmentation (Rosenberg and Raphael, 1986).

SIERRA NEVADA RED FOX

The Sierra Nevada red fox is a medium sized carnivore found throughout the Cascades and Sierra Nevada. Sightings of this animal typically occur between 5000' and 7000'. Preferred habitat is believed to be red fir and lodgepole pine forests in the subalpine zone and alpine fell-fields (Schlorff 1987). It is believed that this fox hunts forest openings, meadows and open rocky areas associated with high elevations. As is the case with other fox species the Sierra Nevada red fox will eat vegetable matter as well as meat. Prey items include marmots, ground squirrels, woodrats, pikas, hares, birds and insects (Schlorff 1987).

The Sierra Nevada red fox is believed to rear young in the cavities and interstitial spaces within rockslides and talus slopes. Sumner and Dixon (1953) believed that such retreats provide adequate protection from predators such as coyotes and bears, as well as providing large concentrations of rodents to feed upon.

Although this species occupies the same habitats as the California spotted owl, it does not appear to require the same habitat components as the owl. In fact, red foxes are generally opportunistic species and are therefore able to adapt to variety of environmental conditions and available food items (Schlorff 1987).

NORTHERN GOSHAWK

The nesting habitat requirements for the goshawk are very similar to those of the California spotted owl. In fact, goshawks are known to prey upon young spotted owls. Both require large diameter trees or snags for nesting, fairly closed canopies, and decadence in the stand.

Potential negative effects on the goshawk from potential timber management activities are primarily associated with the loss or modification of habitat or habitat components. Important habitats and habitat components

are late-seral-stage conifer and deciduous forests with interspersed meadows and riparian areas, snags and dead-topped trees for observation and prey-plucking perches, large diameter trees for nests, a shaded canopy, some open flying space beneath the canopy, and the presence of standing and downed dead wood for prey species. Potential timber management activities can affect all of these habitat components. However, the interspersion of meadows and riparian areas within late-seral-stages forests should not be affected by timber management.

Timber management activities could also cause direct disturbance to nesting goshawks, potentially causing abandonment of nests or decreased nesting success. The spatial distribution of goshawk habitat could be affected by potential management activities. Decreases in habitat across the landscape not only decreases the number of goshawks the landscape can potentially support, but increases habitat fragmentation, with associated effects such as increased edge (which can increase the chance of predation), chance in microclimate, and increased chance of the "packing" phenomenon. In addition, such decreases in habitat decreases the likelihood of individuals finding mates and decreases the likelihood of the successful dispersal of young.

A.IV. GENERAL PROCEDURES FOR ANALYZING EFFECTS TO TESP ANIMAL SPECIES

1. INTRODUCTION

This section, basically developed by Region 1 botanist Steve Shelly and revised and modified for use with Region 5 animals, provides guidelines for analyzing the potential effects of timber harvest/management activities and their alternatives on TESP animal species. An effects analysis is a part of the biological evaluation process, and is required in cases where tesp animals or potential habitat may exist within or near proposed project areas.

Currently, there are 20 taxa (species, subspecies, or populations) included on the Region 5 TESP animal list that are known to occur on Sierran forests in habitats where timber harvesting activities could be prescribed. Each taxon is different with respect to critical life history characteristics, habitat requirements, and ecological sensitivity. In addition, the extent of knowledge concerning these factors varies greatly among these species; for some taxa, there is reliable information regarding their geographic distribution, biology, and/or habitat requirements, while for others virtually nothing is known.

Consequently, it is extremely difficult to generalize about how to analyze the effects of various management activities on all of these taxa. Species or habitats that occur in proposed project areas should therefore be evaluated on a case-by-case basis. In many situations, some research (literature review and/or field studies) will need to be conducted, in order to obtain information on a species life history, autecological requirements, geographic distribution and status, etc. Thus, this biological evaluation will be able to provide: (1) information on critical biological, ecological, and geographical factors, (2) guidelines for conducting effects analysis for TESP animals, (3) types and sources of information and data available and 4) selected references.

2. CRITICAL ASPECTS OF ANIMAL BIOLOGY, AUTECOLOGY, AND GEOGRAPHY

There are a number of factors that have bearing on the level of direct, indirect and cumulative effects to TESP species. Important factors to consider include (a) biology (at the individual, population, and species levels), (b) the autecological characteristics of the species, and (c) the geographic distribution of the occurrences, at local, regional, and rangewide scales.

a. Species Biology

Most of the factors concerning species biology involve research questions beyond the scope of a project-level effects analysis. The summary of factors below is presented mainly to indicate the types and complexities of desirable information.

An understanding of the biology of a particular species is crucial to ensuring its preservation (Massey and Whitson 1980). Wherever possible, informed management decisions should ideally include consideration of the following factors:

1) **Individual Level**
   a) Life history characteristics
   b) Mode of reproduction
   c) Prey relationships

2) **Population Level**
   a) Degree of genetic variation within the population(s)
   b) Population ecology, including predator/prey relationships and disease
   c) Viable population size (a largely undetermined standard for most species)

3) **Species Level**
   a) Degree of genetic variation between populations

b. <u>Autecological Characteristics</u>

It is important to point out the potential usefulness of all types of ecological information, including not only that obtained through detailed quantitative studies, but also qualitative field observations on the part of the biologist conducting the analysis.

The ecological characteristics of TESP species in Region 5 vary widely. Some of the properties that might have bearing on an effects analysis include:

1) Habitat requirements (these requirements may be very specific, or more general)

2) Nature of the species' response to human-caused disturbances

3) Nature of the species' response to natural events, i.e., succession, drought, collapse of prey populations, etc.

4) Nature of the species' response to stochastic events such as fire or flood,

c. <u>Geographic Distribution of Populations</u>

Geographic distribution of populations is a very important consideration when conducting an effects analysis. Disjunct or peripheral occurrences may contain genetic variation that is not present in occurrences that are within the core of a species range; maintenance of these occurrences may be important for ensuring the retention of the evolutionary adaptability and potential of the species. Information may be available regarding the geographic distribution of population centers and habitat. Specific factors that should be addressed include:

1) The number and size of occurrences, at local (project), regional, and rangewide levels. Is the species a geographically restricted endemic, or is it peripheral or disjunct in the project effect area? Are the populations very sparse throughout the range of the species, occurring only in isolated areas containing specific, suitable habitat; or are the populations more evenly distributed, in common habitats?

2) The historical geographic distribution, and the history of rarity (i.e., is the species a neoendemic (recently evolved), or is a population a disjunct relic of a formerly wider range?)

3) The local (project-level) pattern of distribution of the occurrences across the landscape (i.e., divided into adjacent, very close subpopulations; sparsely scattered individuals; populations widely separated from one another). This factor addresses metapopulation structure (i.e., the relationship of populations to landscape features, ecosystem dynamics, and habitat patches).

4) Size and distribution of suitable habitat

The geographic aspect of effects analysis will be addressed in more detail below. Some traits that influence population viability analyses include:

1) Spatial aggregation and metapopulations

2) Resource generality and niche definition

3) Size

4) Effects of inbreeding on genetic stochasticity

3. GUIDELINES FOR CONDUCTING ANALYSES OF EFFECT

This section of the BE analyzes the potential effects of timber management and related activities on TESP animal species in the Sierra Nevada Province. It provides a framework for analyzing the effects of proposed future projects on TESP animals. The process is highly iterative; refinement of the available information and resultant analysis is likely to continue throughout the procedure.

In the presentation of this outline, it is assumed that the analyses would be conducted or reviewed by journey-level biologists who have a basic knowledge of the pertinent taxonomic and ecological literature, detailed knowledge of the fauna of the area, and experience in conducting project reviews and status surveys for TESP animal species through the NEPA process.

a. Review of Available Information

The first stage of an analysis consists of a review of all available information concerning the distribution, ecology, population biology, etc., of the species concerned. The scientific literature should be searched, including both published and unpublished references.

Species lists should be secured from the U.S. Fish and Wildlife Service (USFWS). Species specialists at USFWS may be able to provide further information and/or resources.

In addition, the California Natural Diversity Database should be consulted for locational data and other information regarding the species. Species specialists at the California Department of Fish and Game (CDFG) may also be able to provide assistance.

A summary of the information reviewed should be presented in the appropriate section of the document, either in 'existing environment by species' or the 'analysis of effects by species'.

b. Determining and Prioritizing Cause and Effect Components

Numerous factors may cause a response, beneficial or negative, in a TESP species. These factors include direct, indirect and cumulative effects to occupied or potential habitat, the alteration of habitats adjacent to these sites, and fuels/fire management.

Below is a listing of general project types, followed by examples of the direct and indirect effects, both beneficial and adverse, that can result:

1) **Road Construction**
   a. direct removal of individuals, subpopulations, or the entire population (subsequently reducing overall numbers and, possibly, population or species viability).
   b. direct removal or alteration of habitat
   c. promotion of exotic species invasion along disturbed corridors
   d. alteration of surface and/or subsurface hydrology
   e. dust, or siltation of aquatic habitats
   f. easier access of livestock to habitats
   g. population fragmentation
   h. disturbance
   i. creation of movement corridors
   j. road kills

2) **Timber Harvesting**
   a. direct removal of reproductive sites
   b. alteration of the microclimate (i.e., understory is more exposed to sunlight and wind)
   c. increased soil erosion into riparian zones, streams
   d. disruption of ecological relationships (ie., predator/prey interdependence)
   e. alteration of habitat via change in successional stage of associated vegetation
   f. alteration of surface and/or subsurface hydrology
   g. population and/or habitat fragmentation
   h. creation of barriers to dispersal
   i. isolation of populations
   j. change in forest structural elements (density,# layers)
   k. alteration of special habitat components such as snags, coarse woody debris (CWD), ground cover, etc.

3) **Livestock Grazing**
   a. direct impacts to individuals, subpopulations, or the entire population
   b. change in successional stage of associated vegetation
   c. increased soil erosion and sedimentation to streams
   d. changes in surface and subsurface hydrology

4) **Mining**
   a. direct impacts to individuals, subpopulations, or the entire population and suitable habitat
   b. population fragmentation
   c. disturbance
   d. soil erosion and sedimentation
   e. changes in hydrology

5) **Recreation**
   a. direct impacts to individuals, subpopulations, or the entire population, ie., by trail construction and use
   b. alteration of habitats
   c. increased access for hunters/poachers/observers
   d. introduction of non-natives that are able to out compete the native species
   e. disturbance from noise, pets, harrassment
   f. acclimitization to human presence

6) **Fire Suppression**
   a. changes in successional stage (towards advanced stages)
   b. denser vegetative canopy cover
   c. shift in forest and understory composition toward more shade tolerant species

7) **Occurrence of Fire**
   a. alteration of suitable foraging or resting habitat
   b. changes in successional stage (towards early stages)
   c. loss of reproductive sites (nesting habitat)
   d. loss of special habitat components such as snags or CWD

All of the above causes and subsequent effects may also result in changes in population biology, species distribution and abundance, and the genetic structure of a population.

If habitat is modified or lost, or a disturbance that disrupts behavioral activities causes displacement of an animal from a site, it is likely to shift its range to adjacent territories. This results in a phenomena known as 'packing'. As described in the Interagency Scientific Committee Report on the conservation of the Northern spotted owl (Thomas et al. 1990), packing occurs when individuals temporarily escape from a place where habitat is being degraded or destroyed. They move into nearby patches of undisturbed habitat. These undisturbed habitats generally exhibit an increased density of individuals in the period immediately following the disturbance. Given the limited resources on any one site, intra-specific competition increases and the displaced individuals are not able to persist there indefinitely.

The result of packing is an apparent increased density in patches of habitat that remain suitable for the species. This is a false impression, since the actual explanation for the occurrence is packing by a species whose population may otherwise be declining due to habitat loss (Thomas et al. 1990). The potential for misinterpretation of data collected in areas where packing is a factor highlights the need to assess effects to populations on as large a geographic scale as possible (Ibid).

In order to assess the **cumulative effects** of habitat loss resulting from past, present and reasonably foreseeable actions, the analysis needs to be conducted over the widest geographic scale possible. If analyses are conducted strictly at the project level, the overall importance of potential effects will be obscured. See the following section regarding spatial limits, for suggested guidelines on this aspect of analysis.

c. Determination of Spatial and Temporal Limits of the Analysis

1) Spatial Limits

In order to conduct a complete analysis of the effects of a proposed action on a TESP species, it is important to address several different geographic scales. Specifically, the analysis should include a summary of the species distribution on all of the following levels:

a) global range of the species
b) statewide range of the species
c) distribution and status of the species on a National Forest
d) distribution and status of the species within and near the proposed project effect area

Information on the total range of the species is needed in order to ascertain the overall importance of the occurrence. For example, a peripheral or disjunct occurrence may be very important in maintaining the overall geographic structure of the species. All occurrences of an

endemic species may be important in maintaining rangewide viability. If these large-scale patterns are not included in the analysis, the significance of the population may be diminished or obscured. However, a complete rangewide distribution summary is often unavailable, or is difficult to obtain for some parts of the species range. Reference to state and regional faunas, the California Natural Diversity Database, literature reviews, and contacts with researchers and managers can be used to gain a more complete picture.

At the state level, the status of a species is often more readily available, from appropriate Natural Heritage Programs. Information on the extent and locations of sightings or habitat may be obtained. These data can be used to assess current status, and to guide additional field inventories.

At the National Forest level, information on distribution and abundance of the population or its habitat is important for assessing the extent of the potential impacts over a narrower geographic area.

At the project level, information on the size and areal extent of suitable habitat, both inside **and** outside the proposed project boundaries, is needed. In cases where a figure for habitat acreages can be obtained, a numerical assessment of the potential effects can be made. Such data can be obtained by examining and field checking timber inventories and maps, aerial photo interpretation or GIS systems where they exist.

Depending upon the extent of the population, acreage of suitable habitat and the percentage that will be lost or degraded in specific areas, mitigation measures can be devised to avoid or minimize direct and indirect effects. This approach addresses the concept of the metapopulation.

Another category of spatial effects is those that occur off site as a result of project implementation. An excellent illustration of this type of effect is downstream sedimentation in streams. The effect manifests off the project site, but occurs as a direct result of operations such as road construction, timber harvest, etc. It is important to consider mitigation of these impacts.

2) Temporal Limits

In cases where TESP animals are found within proposed project areas, physical impacts would be immediate. However, many species may be more susceptible to longer-term residual effects, beyond the time of completion of activity. Shifts in habitat suitability due to successional changes, or slow changes in hydrology are examples of such effects. Unfortunately, the exact impacts of these residual effects is largely unknown for many species, and field observations must be relied upon to make the most informed assessment possible.

In summary, owing to the variability in life history, ecology and disturbance tolerance of TESP animal species, the temporal extent of the analysis will vary on a species- and project-level basis. It may also be appropriate to analyze and display effects to prey populations and their habitat. Professional judgment, based on existing data, is required.

d. <u>Describing the Existing Condition</u>

A complete description of the existing condition is crucial to a sufficient analysis. Although there is a variably-sized body of literature concerning field survey methods for TESP species and their habitats, few references are available.

e. Predicting Effects

The prediction of effects is the most difficult aspect of conducting analyses for TESP animals, because there is generally little detailed information on the ecology or population dynamics of so many species. However, there are some methods available to assist in gathering information or quantitative data. These include demographic monitoring studies, experimental or administrative studies, and consultation with experts.

Approaches to demographic monitoring are numerous. Monitoring studies can provide extremely detailed information regarding response to habitat changes or disturbance; however, they are usually labor-intensive. They also generally require a longer time period, usually at least several years, in order to obtain adequate data to assess or predict trends. Once the data are available, though, they can provide a means of assessing population viability.

Experimental studies provide another means of assessing the potential effects of management activities. Also, previously established "experiments" (i.e., prior land management activities) may provide insights into use of altered and/or remaining habitats. In cases where proposed project effects have been largely mitigated, but the loss of some individuals will take place, establishment of monitoring plots in disturbed and undisturbed habitat can provide information for future, similar situations.

Consultation with experts is also a means of obtaining information that can be used to assess potential effects. A good starting point is to review the literature, contact the Regional Office specialist, PSW scientist, local colleges, etc., for reference to a species specialist.

In some cases, extremely useful information can be obtained through literature review. The Natural Diversity Database, or experts that are consulted, may be able to provide published and unpublished references.

Items to consider in the analysis of effects include: species present in the analysis area, harvest method (eg. tractor, cable, helicopter), intensity of activity, duration, effects of recent and foreseeable management activities, number of acres entered, season of operation, volume harvested, silvicultural prescription, fuels treatment, miles of road constructed or reconstructed, number and type of stream crossings, and possible mitigations.

Frequently, there will not be any substantial information available on the response of various species to the factors listed above. In these situations, it is important to remain conservative in predicting effects and prescribing mitigation measures. In general, while the loss or displacement of a few individuals may be deemed insignificant, it will generally be very important to maintain the overall distribution of component subpopulations. The maintenance subpopulation "distribution viability" can serve as a partial index for maintaining less easily-observed features that affect the viability of the species, ie., genetic variation patterns, predator/prey relationships, dispersal patterns, and gene flow within and between populations. Thus, an analysis of effects can only be conducted in response to site specific proposals that describe the 13 factors listed above.

An emerging concept in conservation biology concerning metapopulation structure and dynamics can be used to address "distribution viability." A metapopulation is defined as "...a collection of interdependent populations affected by recurrent extinctions and linked by recolonizations" (Murphy et al. 1990). An excellent review of the importance of metapopulation structure to the maintenance of population viability is provided by Gilpin (1987). The importance of metapopulations is also summarized by Rohlf (1991).

The existence of many populations is critical for species that inhabit patches in a shifting mosaic of habitats. Multiple populations also serve as a source of colonists and thus as a hedge against

environmental stochasticity. And, metapopulation dynamics are likely to become increasingly important as habitat areas become fragmented. Thus, the maintenance of metapopulation structure will most adequately allow the population to withstand land management effects (as well as future natural habitat changes). This approach is especially useful in light of the fact that the quantitative viability thresholds for TESP species are largely unknown.

f. Documentation

The final analysis documentation should include:

1) Summary of the pre-analysis literature/information review

2) Personnel conducting field surveys and follow-up analyses

3) Results of field surveys, including qualitative and quantitative observations (some of this will have been covered in the body of the biological evaluation):
   a) Table of results of inventory or survey
   b) A discussion, preferably referencing a map, presenting the distribution pattern of the potentially affected species and its habitat
   c) Other pertinent observations on the biology or ecology of the species

4) Delineation of the available alternatives and their predicted effects on TESP species; include the "no action" alternative as a basis for comparison

5) A clear determination of effects

6) Literature cited and list of experts consulted

7) Copies of appropriate field survey forms, maps, etc.

8) The disposition of supporting materials (field notes, habitat maps, photos, areas inventoried, etc.)

9) Correspondence with USFWS

g. Results of Consultation with USFWS

This should include a phone log for informal conversations with USFWS personnel, the Biological Opinion if it was required, or a USFWS letter of concurrence with the Forest Service determination of effect in all cases other than "no effect".

h. Determination of Analysis Intensity

Some factors influencing the intensity of surveys for TESP species and their habitats are summarized below:

FACTOR	MORE INTENSIVE SURVEY NEEDED	LESS INTENSIVE SURVEY IS ACCEPTABLE
Degree of Endemism	Narrowly endemic	Broadly distributed beyond the range of the California spotted owl
Abundance	Rare	Common
Harvest Acreage Entered	Extensive	Smaller area
Volume Harvested	High	Low
Silvicultural Prescription	Major shift in successional stage	Components reduced, but seral stage unchanged
Special Habitat Components (Snags, CWD)	Reduced	Conserved

The factors outlined here are intended to be general guidelines. The level of analysis intensity involves professional judgment on the part of the biologist. The most important factor influencing analysis intensity will be the nature and extent of potential impacts from a proposed project. As emphasized earlier, it will also often be important to expand the area of analysis outside the project effect area.

4. SOURCES OF INFORMATION

A variety of sources of information regarding the biology and distribution of species may be consulted during an effects analysis. The following list describes these sources.

a. Faunas (state and regional) and other published scientific literature.

b. Previously prepared environmental impact statements, NEPA documents, unpublished theses and survey/inventory results.

c. Previously prepared status reports on particular species.

d. University or museum collections.

e. Knowledgeable persons.

f. The California Natural Diversity Database, which contains the computer-assisted inventories of the locations and status of selected species. These locations can also be mapped.

5. SUMMARY

Based on the analysis within the accompanying EA, there is no accurate way to determine what factors may be influenced by the three alternatives. This will require site-specific analysis.

Since detailed demographic and life history information for potentially affected TESP species is often lacking, professional judgment by the biologist based on the best available information will be needed. The key considerations, when these detailed data are not available, will be

a. **ecological response**,

b. **geographic distribution**,

c. **timing**, **Intensity** and **frequency** of the proposed actions.

Important ecological considerations include, but are not limited to:

a. **The relationship of the species to vegetation succession** under various disturbance regimes.

b. **The sensitivity of the habitat relationship** (i.e., is the species highly restricted to one forest type and structure or unique, vulnerable habitat [bogs, fens, seepage areas, etc.], or is it less specific in its requirements [occurring in more common, "resilient" habitats?).

Important geographic considerations, as reviewed earlier are aimed primarily at the retention of the "distribution viability" of the species (i.e., whole populations, or subpopulations and occurrences where the species has a patchy distribution in the analysis area). This approach should serve as a reasonable substitute for maintaining underlying population and metapopulation structure, genetic variation patterns, demographic processes, and other less-easily analyzed aspects of population viability.

Numerical summaries of population and subpopulation size can be useful in providing an indication of the extent of potential impacts. In general, however, heavy reliance on numerical analysis of population size should be avoided, since the quantitative thresholds for viability are unknown for most species. The task of assessing the probability of adverse effects will remain a matter of professional judgment in most cases.

Monitoring of known populations, by periodic field checks (to determine overall trends in the number of populations) and detailed population-level demographic studies (to assess the effects of management activities), will be increasingly important in the production of good effects analyses. Such monitoring is best conducted by Ranger District and National Forest staff.

In the future, the development of conservation strategies for individual species, or sets of species that share a common habitat, will be emphasized in Region 5. Where these are available for a potentially affected species, the project-level biological evaluation/effects analysis should be based on the recommendations in the conservation strategy.

In the interim, follow Forest LRMP Standards and Guidelines, Best Management Practices (BMPs), the Regional Guide, Forest Service Manual and Handbook, the scientific literature and expertise of individuals.

6. MAKING DETERMINATIONS OF EFFECT

The wording of determinations should be as follows:

a. Sensitive species
1) no effect
2) may affect, but not likely to result in a trend toward Federal listing
3) may affect; likely to result in a trend toward Federal listing.

b. Threatened or endangered species
1) no effect

2) may affect, but not likely to adversely affect
3) may affect; likely to adversely effect.

c. Species proposed for listing

1) no effect
2) may affect, but not likely to jeopardize the continued existence of the species
3) may affect and likely to jeopardize the continued existence of the species.

A.V. DETERMINATION OF EFFECTS

Selection of any of the three proposed alternatives for interim management guidelines for the California spotted owl, should not adversely affect any TESP species other than the California spotted owl. Existing standards and guidelines for other TESP species remain in effect. All projects will be analyzed in a site-specific BE and project design standards or mitigating measures for other species will be incorporated in individual projects to ensure projects will not adversely affect listed species and are not likely to result in a trend toward Federal listing of sensitive species. If a may affect determination results from any project BE for any TEP species, conference or consultation with USFWS will be initiated.

For the California spotted owl, selection of Alternative 1 (SOHA Strategy) is likely to result in a trend toward Federal listing because of its failure to maintain future management options by maintaining the population in its relatively even distribution throughout the forests of the western slope of the Sierra Nevada. Specifically, this alternative fails to retain key habitat components that have been declining throughout the Sierra Nevada province (i.e. large trees, large snags and downed wood) and does not protect the nest sites of three quarters of known owls. Alternatives 2 and 3 are not likely to result in a trend toward Federal listing of the owl because they each retain key habitat components across the landscape and protect all currently known nest sites. This determination is based upon the detailed analysis provided in the CASPO Report and the California Spotted Owl Interim Guidelines EA.

A.VI. SUGGESTED MITIGATION MEASURES

MITIGATIONS COMMON TO ALL SPECIES

1. Forests will prepare site-specific BEs for all projects designed under the interim guidelines selected by the accompanying EA and will determine the extent and scope of project design and mitigation appropriate for each species.

2. If site specific BEs result in a may affect determination for TEP species, initiate conferencing or consultation with USFWS.

3. When writing a site-specific BE, consider implementing limited operating periods when appropriate by including contract clause C(T)6.313. Contract clause C(T)6.25 may also be implemented when threatened and/or endangered species or their habitats are present.

SUGGESTED MITIGATIONS FOR CALIFORNIA CONDOR

1. Informally consult with the USFWS California Condor Recovery Program prior to project initiation to determine if released condors are utilizing National Forest System lands within the southern Sierra Nevadas. If condors are identified on any Forest, appropriate mitigation measures would be implemented as needed at that time. This may include protection of nest and roost trees and establishment of a Limited Operating Period during the nesting season.

2. Potential condor roost areas have been identified on the Sequoia National Forest map. Within these areas, specific high value roost trees have been identified and cataloged. Flag and protect these trees from harvest activities; provide a buffer zone surrounding these trees equivalent to the average height of surrounding overstory trees (to protect the roost trees from damage during felling/yarding operations).

SUGGESTED MITIGATIONS FOR BALD EAGLE

1. Establishing buffer zones around nests not only preserves the habitat, but also visually isolates raptors from disturbance (Stahlmaster and Newman 1978). Where a site management plan does not exist, consider using spatial and temporal constraints to establish a protected core zone surrounded by an area in which allowable management is mitigated by use of a Limited Operating Period (LOP).

SUGGESTED MITIGATIONS FOR ALL AQUATIC THREATENED AND ENDANGERED SPECIES

1. Consider use of a helicopter logging system within affected basins.

2. Try to minimize group selection cuts larger than 2 acres.

3. Consider avoiding harvest associated activities under wet conditions. Winter hauling is acceptable where all roads are gravel, chip sealed or paved. Try to minimize winter hauling otherwise.

4. Consider a prohibition on drafting water from streams for dust abatement purposes in the range of the 6 listed fish and the Shasta crayfish.

SUGGESTED MITIGATIONS FOR SHASTA CRAYFISH

In addition to the aquatic species' mitigations, consider the following items:

1. Consider establishing a 200 foot Riparian Management Zone (RMZ) in which no harvest or associated activities will occur surrounding sites identified as potential Shasta crayfish refuges.

2. Consider the use of administrative road closures during harvest activities to limit access to Shasta crayfish potential habitat to the public.

SUGGESTED MITIGATIONS FOR GREAT GRAY OWL

1. A limited operating period for timber harvest and associated activities from March 1 to August 31 within 0.25 mile of all known great gray owl nests and in potential habitat where surveys have not occurred will eliminate the chance of direct disturbance on nesting great gray owls.

2. Potential nest trees can be constructed in suitable habitat with shortages of snags. For each great gray owl territory, construct 5 to 10 suitable concave tops in existing snags, preferably red or white fir. Snags selected for this process should be at least 21" dbh and 20 feet tall.

SUGGESTED MITIGATIONS FOR WILLOW FLYCATCHER

1. Suitable meadow habitat can be buffered with a 100 foot buffer to prevent disturbance to vegetative cover and preserve the meadow microclimate; no harvest or associated activities would occur in this buffer.

2. Negative effects on water flows can be mitigated by restricting activities in areas upslope from suitable meadow or stream habitat which affect the surface and subsurface water flows. Such activities include

road or landing construction or reconstruction across slopes which intersect surface or subsurface water flows or the compaction of areas which store surface water or funnel water into subsurface sources.

SUGGESTED MITIGATIONS FOR MARTEN

1. Try to avoid placement of landings on ridgelines in order to prevent disruption of the vegetative cover used for dispersal.

SUGGESTED MITIGATIONS FOR PACIFIC FISHER

1. In suitable fisher habitat, open road densities should not exceed 1 mile per square mile. Roads less than 16 feet wide and receiving minimal use (e.g., use only from logging) should not affect fisher movements and may be excluded from this assessment.

2. In situations where it does not pose a fire hazard, pile logging slash along the perimeter of small patch cuts bordering mature forest areas. Large piles are preferable to a maximum of 100 feet by 25 feet.

SUGGESTED MITIGATIONS FOR NORTHERN GOSHAWK

1. Disturbance to nesting goshawks can be mitigated by establishing a limited operating period one-quarter mile around nest sites and in suitable habitat which has not been surveyed, such that no harvest or associated activities would occur from March 15 thru August 15.

A.VII. LITERATURE CITED

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Subpart B

PLANTS

B.I. EXISTING ENVIRONMENT/SPECIES ACCOUNT

This document provides physiographic province (Sierra Nevada) and regional level standardization of biological evaluations and project design standards (PDS) for timber management and associated activities to allow a determination of "no effect/no impact" on threatened, endangered, sensitive and proposed (TESP) plant species. The background documentation used as a template for this biological evaluation was developed by Eldorado Forest Botanist Mike Foster and revised and modified for this specific Environmental Assessment.

This programatic biological evaluation (BE) does not relieve the Forest Service (FS) of the requirement to conduct site-specific project analyses. Consequently, a site-specific BE, whether brief or lengthy, must be prepared for each proposed project.

The Sierra Nevada Province is defined as the National Forest System lands that extend from the Modoc National Forest in the north to the Sequoia National Forest in the south.

FEDERALLY LISTED THREATENED, ENDANGERED, AND PROPOSED PLANT SPECIES IN THE SIERRA NEVADA PROVICNE

Only one species, Mahonia sonnei Abrams, is listed under the Endangered Species Act of 1973 (as amended). Mahonia sonnei is restricted to a single occurrence along the Truckee River (on private land within the Tahoe NF), and an experimental transplant occurrence nearby. No other federally endangered or threatened plant species are known or suspected to occur on the Sierra Province National Forests (USDA Forest Service 1990).

SENSITIVE PLANT SPECIES ON NFS LANDS IN THE SIERRA NEVADA PROVINCE

The primary purpose of this biological evaluation (BE) is to help identify those sensitive plant species that could be within coniferous stands available for timber management and associated activities within the range of the California spotted owl. There are 102 sensitive plant species listed by the Regional Forester for the Sierra Nevada Province National Forests as identified in the latest sensitive plant list developed in 1990 and referenced in FSH 2609.25. Of these 102 sensitive plants, it was determined, based on review of habitat requirements, that 58 of the 102 taxa are known or are suspected to occur in forested environments where timber management activities may be prescribed.

A prefield review of District and Forest sensitive plant files and maps has determined that no suitable habitats are present in the areas that have the potential to be considered for timber management activities for 44 sensitive plant species (USDA Forest Service 1992). These sensitive plants will not be considered further in this biological evaluation since they occur in specific non-timbered habitats.

The 58 sensitive plant species listed in Table 1 have been determined to be species of concern in this biological evaluation. This determination is based on the presence of documented occurrences and/or potential habitat for these species in areas with potential to be disturbed by timber management, associated operations and related activities. At this time, it has not been determined how many of these sensitive plant species are associated with forest stands that also provide habitat for California spotted owls.

Table 1. Sensitive Plant Species of Concern for Timber Management Activities in the Sierra Nevada Province.

	SENSITIVE PLANT SPECIES	NATIONAL FOREST
1	Allium tribracteatum	Stanislaus
2	Allium yosemitense	Sierra, Stanislaus
3	Antennaria flagellaris	Modoc
4	Arabis constancei	Lassen, Plumas
5	Arabis rigidissima var. demota	LTBMU
6	Asplenium septentrionale	Lassen
7	Astragalus lentiformis	Plumas
8	Astragalus webberi	Plumas, Tahoe
9	Calochortus clavatus var. avius	Eldorado
10	Calochortus longibarbatus	Lassen, Modoc
11	Calochortus westonii	Sequoia
12	Camissonia sierrae ssp. alticola	Sierra
13	Campanula wilkinsiana	Lassen
14	Carpenteria californica	Sierra
15	Clarkia australis	Stanislaus
16	Collomia debilis var. larsenii	Modoc
17	Collomia rawsoniana	Sierra
18	Erigeron multiceps	Sequoia
19	Eriogonum prattenianum var. avium	Sierra
20	Eriogonum prociduum	Modoc
21	Eriogonum twisselmanii	Sequoia
22	Eriogonum umbellatum var. torreyanum	LTBMU, Tahoe
23	Eriophyllum congdonii	Sierra, Stanislaus
24	Eriophyllum nubigenum	Stanislaus
25	Erythronium pluriflorum	Sierra
26	Erythronium tuolumnense	Stanislaus
27	Fritillaria eastwoodiae	Lassen, Plumas, Tahoe
28	Galium glabrescens ssp. modocense	Modoc
29	Galium serpenticum ssp. warnerense	Modoc
30	Gratiola heterosepala	Lassen
31	Horkelia tularensis	Sequoia
32	Ivesia aperta	Plumas
33	Ivesia baileyi	Plumas
34	Ivesia paniculata	Modoc
35	Ivesia sericoleuca	Plumas, Tahoe
36	Ivesia unguiculata	Sierra
37	Ivesia webberi	Plumas
38	Lewisia cantelowii	Plumas
39	Lewisia congdonii	Sierra, Stanislaus
40	Lewisia serrata	Plumas, Tahoe
41	Lupinus citrinus	Sierra
42	Lupinus dalesae	Lassen, Plumas
43	Mimulus filicaulis	Sierra, Stanislaus

	SENSITIVE PLANT SPECIES	NATIONAL FOREST
44	Mimulus pygmaeus	Lassen
45	Monardella stebbinsii	Plumas
46	Orcuttia tenuis	Lassen
47	Navarretia prolifera ssp. lutea	Eldorado
48	Nemacladus twisselmanii	Sequoia
49	Oreonana purpurascens	Sequoia
50	Penstemon personatus	Lassen, Plumas
51	Phacelia stebbinsii	Eldorado, Tahoe
52	Raillardiopsis muirii	Sequoia, Sierra
53	Sedum albomarginatum	Lassen, Plumas
54	Senecio eurycephalus var. lewisrosei	Lassen, Plumas
55	Silene invisa	Eldorado, LTBMU, Plumas, Stanislaus, Tahoe
56	Trifolium bolanderi	Sierra
57	Trillium ovatum ssp. oettingeri	Lassen
58	Vaccinium coccinium	Plumas, Tahoe

RANGE, DISTRIBUTION, AND SUITABLE HABITAT FOR SPECIES OF CONCERN

Habitat capability models for sensitive plant species have not been developed. The following descriptions of suitable habitats are based on review of occurrence records, field observations of contributors, and various resource aids such as soil maps, vegetation maps, topographic maps, and aerial photographs.

The 58 sensitive plants that could possibly be affected by timber management and associated activities are as follows:

1. Allium tribracteatum (Three-bracted onion)

This species is endemic to the Stanislaus National Forest (NF) and adjoining private lands. There are approximately 20 known occurrences. Most occur on the Summit or MiWok Ranger Districts. The elevational range for Allium tribracteatum is 3,000 to 9,400 feet.

Allium tribracteatum grows on gravelly lahar (volcanic mud flow) soils, often referred to as "lava caps." The sites are usually open with no overstory. In some instances, brush species such as manzanita (Arctostaphylos sp.) may be present. Merchantable timber is usually absent on these sites, though conifers often occur nearby. There have been instances where log decks or landings have been planned in areas of suitable habitat.

2. Allium yosemitense (Yosemite onion)

Allium yosemitense is a perennial herb with a limited range in the central Sierra Nevada. Allium yosemitense occurs in 15 known locations, 3 of which are on the Stanislaus NF, 12 on the Sierra NF, and 1 in Yosemite National Park. The elevational range for this species is 1,500 to 7,000 feet. It is likely that more occurrences of this species will be found due to the presence of unsurveyed suitable habitat.

Allium yosemitense grows in metasedimentary soils with a high amount of metasedimentary scree or cobble on the surface. There is often exposed bedrock at these sites. The sites are usually open, having little or no tree canopy. These areas are not generally considered capable of growing timber. However, in some instances, commercial species may be found growing near these rock outcrops.

3. Antennaria flagellaris (Stoloniferous pussy-toes)

Suitable habitat for this species is in microhabitats in the low sage flats of the Modoc Plateau. These sites are often used for road locations for logging and other forest management activities. Eight populations are currently known to occur on the Modoc NF.

4. Arabis constancei (Constance's rock-cress)

Arabis constancei occurs on serpentine soil in scattered locations in the Tahoe, Plumas, and southernmost part of the Lassen NFs. Its main distribution occurs on the Plumas NF. On the Lassen NF, only one occurrence is known. This single occurrence consists of five small patches within about a half mile diameter area. The number of plants here has varied from an estimated 90 plants in 1990 to 578 plants in 1988. This occurrence is on the southwestern edge of the Forest in the Yellow Creek area of the Almanor Ranger District.

Habitat for A. constancei on the Lassen NF consists of serpentine rock outcrops and soil in a mixed conifer forest at about 4,200 feet elevation. The occurrence is on a west facing, moderate slope. Associates include Pinus ponderosa, Calocedrus decurrens, Pinus lambertiana, and Pseudotsuga menziesii in the open overstory, a sparse shrub layer including Ceanothus cuneatus and Arctostaphylos viscida, and a moderate to sparse herbaceous layer of Phlox diffusa, Castilleja applegatei, Fritillaria recurva and others. Other Sensitive plants in the area are Senecio eurycephalus var. lewisrosei and Sedum albomarginatum.

Not all factors limiting distribution for this plant have been identified, but its apparent restriction to serpentine areas explains its rarity on the Lassen NF, where such habitat is very limited.

Arabis constancei has not been observed on disturbed sites on the Lassen NF. In the absence of more specific information on minimum numbers and occurrences needed to sustain viability and response to disturbance, a conservative approach is appropriate.

There are 28 documented occurrences of this perennial herb on the Plumas NF. This serpentine endemic is often found in or near managed stands of forest.

5. Arabis rigidissima var. demota (Galena Creek rock cress)

Habitat for Arabis rigidissima var. demota includes open, rocky areas along forest edges of conifer and/or aspen stands. Usually found on northerly aspects above 7,500 feet, the populations are a regional endemic, known to occur only in the Carson Range of the Sierra Nevada in southern Washoe County. (Tiehm 1989). Five locations of Galena Creek rock cress are known to occur in the Lake Tahoe basin. Two locations are found near Martis Peak. The remaining three known locations are found near Mt. Rose.

6. Asplenium septentrionale (Northern spleenwort)

In California, A. septentrionale is known only from Lassen Volcanic National Park (NP), Lassen NF, and Sequoia NP. In Sequoia NP, only two occurrences are recorded, according to the Natural Diversity Data Base of the California Department of Fish and Game, and one of those has not been located since 1942, despite several searches in the 1970s and 1980s. In Lassen Volcanic NP, four occurrences are known, at least one of which has not been seen in recent years. Lassen NF has two known occurrences, near Christie Hill on the Almanor Ranger District, and near Manzanita Chutes on the Hat Creek Ranger District.

Outside of California, A. septentrionale occurs rarely in Oregon and Washington, and at widely scattered locations in South Dakota, Wyoming, Colorado, Oklahoma, Texas, New Mexico, Arizona, and West Virginia, but apparently is not common anywhere. It also occurs in Eurasia. It may have been more common during the pleistocene when the climate in North America was cooler and wetter, but now is a relict restricted to certain relatively high elevation shaded rock faces.

Asplenium septentrionale is a small fern with narrow, grasslike fronds. It is found on dacite rock boulders and outcrops which are partially shaded, generally on the east and north facing slopes of the hill. It is epiphytic in the cracks on the rocks and is found on rocks ranging from medium to large rock outcrops. The plants are generally limited to north and east faces of the rocks or places where overhanging rocks or tree canopy provide cover. The vegetation type is red fir forest (with sugar pine) or montane chaparral areas. Shrub associates include Arctostaphylos patula, A. nevadensis, Quercus vaccinifolia, and Chrysolepis sempervirens. Very few species besides the Asplenium grow on the rocks, but occasionally Carex rossii or Hieracium horridum occur in the large cracks, as well as on the ground. It is found at elevations from 5,300 to 6,400 feet on the Lassen NF (and higher in the National Park).

7. Astragalus lentiformis (Lens-pod milk vetch)

There are 45 documented occurrences of this perennial herb, all of which are located within the boundaries of the Plumas NF. These occurrences are restricted to the Beckwourth and Milford Ranger Districts. This plant is found on volcanic soils, between 4,500 and 6,200 feet in elevation, in eastside pine, eastside pine/sagebrush scrub, or sagebrush scrub/grassy flats, frequently in areas that are CAS timber sites. The tolerance of A. lentiformis to disturbance has not been determined.

8. Astragalus webberi (Webber's milk vetch)

There are seven documented occurrences of this species on the Plumas NF. It occurs on rocky soils in mixed conifer forest.

9. Calochortus clavatus var. avius (Pleasant Valley mariposa lily)

This species is endemic to the Eldorado NF and adjoining private lands. There are 101 documented occurrences in a roughly 420 square-mile area. New occurrences continue to be discovered, primarily by Forest Service field personnel, e.g., 25 new occurrences were discovered during the 1992 field season. Discoveries in recent years have not substantially increased the known range of C. clavatus var. avius.

Suitable habitat for C. clavatus var. avius consists of openings in or adjacent to mixed conifer and ponderosa pine forests at elevations of 2,800 to 5,600 feet. The presence of C. clavatus var. avius in open stands of conifers may indicate an intolerance of deep shade and/or thick duff. Fire appears to be a key habitat component, as evidence of fire in the form of fire scarred trees and logs is apparent at the majority of occurrences.

Habitat management objectives for C. clavatus var. avius are frequently contrary to, at least in part, the timber management objectives at a majority of the known occurrences of this category 1 candidate taxon.

10. Calochortus longibarbatus (Long-haired star tulip)

Calochortus longibarbatus var. longibarbatus occurs in eastern Washington, Oregon, the Shasta-Trinity, Modoc, and Lassen NFs, with Lassen NF area occurrences being at the south edge of its range. Only one remaining Lassen NF occurrence is known, near Wiley Ranch in the Hat Creek Ranger District. Two other Lassen occurrence locations were recently eliminated from public ownership in a land exchange. The plant is more common on the Shasta-Trinity and Modoc NFs.

Calochortus longibarbatus grows at the ecotone between seasonally wet meadows and conifer forests on the east side of the Wiley Ranch meadow. Its habitat requirements are seasonal soil moisture in grassy openings and meadows, usually in eastside pine forests. According to a draft species management guide for C. longibarbatus from the Fremont NF in Oregon, temporary moisture in the habitat arrives from precipitation or subsurface flow, and does not collect on the site to form anaerobic or water-logged soil. Occurrences

are generally on flat to gentle slopes. The Wiley Ranch occurrence differs from most other occurrences in being more associated with the tree line, according to observations by Jim Jokerst.

11. Calochortus westonii (Shirley Meadows mariposa)

This perennial herb is found in well drained soils in openings of mixed conifer forest that are dominated by white fir and incense cedar primarily within the Greenhorn Mountains, Tulare County (Sequoia NF).

12. Camissonia sierrae ssp. alticola (High Sierra evening primrose)

This ephemeral annual grows in gravelly granite "pans", generally at elevations above 6,500 feet. Plants germinate, flower, and set seed in the course of just a few weeks. Most known occurrences are found in the vicinity of Florence Lake and Bear Creek, at the border of the John Muir Wilderness (Sierra NF), although new populations continue to be discovered on CAS lands when searches are conducted during the blooming period.

13. Campanula wilkinsiana (Wilkin's harebell)

Campanula wilkinsiana occurs mainly in Siskiyou and Trinity Counties, on the Shasta-Trinity NF. It is included on the Lassen NF Sensitive Species list based on a 1942 collection from "Deer Creek Meadows, Plumas County". The Deer Creek Meadows on the Lassen NF is actually in Tehama County, but not far from the Plumas County line, so the location is questionable. Most of the Deer Creek Meadows are on private land. No other collections or records from or near the Lassen NF are known.

The habitat for C. wilkinsiana is moist places, generally wet meadows or near streams on sandy soil, in mixed conifer, red fir, or subalpine zones. Its elevation range is from 5,000 to 8,500 feet.

14. Carpenteria californica (Tree anemone)

This evergreen shrub occurs at elevations from 1,500 to 4,000 feet, mostly in chaparral, but some plants are found in the lower yellow pine belt. The entire distribution of this species is found within an area of 225 square-miles defined by the San Joaquin River to the north and the Kings River to the south. This shrub tends to concentrate and grow most vigorously in draws and ravines with well-drained granitic soils where moisture is relatively abundant. Harvest of trees adjacent to shrubs could be detrimental to the species by exposing them to excessive sunlight or otherwise changing the microenvironment in a negative manner.

15. Clarkia australis (Small's southern clarkia)

Clarkia australis is an annual herb endemic to the area between the Middle Fork of the Tuolumne River and the slopes above the Middle Fork of the Merced River, and as far west as the Stanislaus NF boundary. With the exception of one occurrence just inside Yosemite NP, the species occurs no farther east than the Forest/Park boundary. The elevational range for C. australis is 2,500 to 6,000 feet. There are approximately 200 known occurrences of C. australis on the Stanislaus NF. One occurrence is known from private property. One occurrence is known from Yosemite National Park.

Clarkia australis grows in openings in ponderosa pine and mix-conifer forests often in association with bear clover (Chamaebatia foliolosa). Clarkia australis also occurs on slopes previously occupied by brush but now exposed by the Complex Fires of 1987 and the Arch-Rock Fire of 1990. Clarkia australis will grow on a site where manzanita and annuals are present in small numbers and in open areas within manzanita stands. Clarkia australis tends to favor sandy or loamy soils of granitic origin but will grow on soils of metasedimentary origin with high clay content. Soils may be deep or shallow, rocky or not rocky. This species is apparently adapted to a frequent fire regime as it has been observed to flourish after fire and occurs in areas which have burned many times through the recorded history of the area.

16. Collomia debilis var. larsenii (Larsen's collomia)

Suitable habitat for this species consists of loose, volcanic material on the colluvial side slopes of cinder cones and similar landforms. One location is known to date on the Modoc NF (near Little Mt. Hoffman lookout), and there is ample potential habitat for additional populations. The sites that the plants occur on are commonly used for locating logging roads and for roadbed source materials.

17. Collomia rawsoniana (Rawson's flaming trumpet)

This riparian-dependent perennial herb relies upon the moist, cool conditions found along streams in mid-elevation conifer forests. It is endemic to the Sierra NF, and is restricted to the San Joaquin River watershed at elevations of 3,500 to 7,000 feet and to one occurrence along Nelder Creek in the Fresno River watershed. The most vigorous colonies occur at 4,500 feet to 5,500 feet.

This species has the most potential for impact from logging of all the Sierra NF sensitive plants. However the current distributional limits of the species are sufficiently well-documented that protection can be accomplished by avoidance (USDI FWS and USDA Forest Service 1987). Collomia rawsoniana populations are difficult to enumerate, as they occur in colonies of various sizes distributed at various densities along perennial streams and their tributaries. One or two new populations are discovered each year within the known distributional range of the species.

18. Erigeron multiceps (Kern River daisy)

This species is restricted to the Kern Plateau on the Inyo and Sequoia NFs. Habitat is generally openings in coniferous stands in sandy to loamy soils. Occasionally, this species is located along the drier edges of meadows and swales in a Jeffrey pine forest with an understory of big basin sagebrush.

19. Eriogonum prattenianum var. avium (Out-of-the-way buckwheat)

Eriogonum prattenianum var. avium is a low, rounded subshrub first described in 1989. Plants are restricted to granitic and metamorphic outcrops between 4,000 and 9,500 feet. Most occurrences are in the Monarch Wilderness in the vicinity of Kettle Dome, but new populations are being discovered each year on the Sierra NF between this area and the Shuteye Peak area about 30 miles to the north. None of the known occurrences are in habitat vulnerable to harm caused by timber harvest. However, due to the presence of unsurveyed potential habitat, there may be undiscovered populations that are vulnerable to disturbance from logging operations and related activities such as road reconstruction and landing construction.

20. Eriogonum prociduum (prostrate buckwheat)

Suitable habitat is provided by dry, rocky, volcanic slopes and hills with shallow soils, mostly in openings in yellow pine forests or western juniper woodlands. All five known populations occur on the Warner Mountain and Big Valley Ranger Districts of the Modoc NF. The relevant management activities commonly affecting these sites are those associated with road construction and maintenance, and placement of slash and brush piles.

21. Eriogonum twisselmannii (Twisselmann's buckwheat)

Rocky granitic or metamorphic summits in the red fir forests of the Sequoia NF provide habitat for this perennial species.

22. Eriogonum umbellatum var. torreyanum (Torrey's sulphur buckwheat)

Habitat for this species consists of dry, gravelly or stoney sites, often harsh exposures such as ridge tops or steep slopes at elevations of 6,000 to 8,000 feet. This habitat type is present on the LTBMU, but to date no occurrences of this plant have been located there.

This species is known from selected localities in Nevada and Placer Counties, primarily the Donner Summit area. There are nine known occurrences of this species on the Tahoe NF. One occurrence may have been extirpated by the widening of Hwy. 89, and five other locations have not been re-located in recent years despite efforts to do so. It is also known from collections near Webber Lake, Sierra County (1873), along Squaw Creek, Placer County (1885), and it is also reported from Modoc County. Taxa from Southeast Oregon have been assigned to the variety glaberrimum (Gand.) rather than torreyanum (Reveal 1968).

23. Eriophyllum congdonii (Congdon's woolly sunflower)

Eriophyllum congdonii is endemic to the heavily mineralized metasedimentary rock formations of the Merced River Drainage in very shallow soils with manzanita and other brush species growing nearby on deeper soils. These sites are not generally considered capable of growing timber; however, in some instances commercial species may be found growing near these rock outcrops. Of the 16 known occurrences, 9 are found on the Sierra NF and 7 are found on the Stanislaus NF. Population sizes are relatively large, with thousands of plants often occurring within a single population. The elevational range for this annual sunflower is 1,600 to 5,200 feet. It is believed that more occurrences of E. congdonii will be found since there are areas with unsurveyed suitable habitat.

24. Eriophyllum nubigenum (Yosemite woolly sunflower)

Eriophyllum nubigenum is an annual herb of very limited range. There are only three occurrences currently known on the Stanislaus NF. These are all in a two mile section of Pilot Ridge on the Groveland Ranger District. Yosemite NP supports at least nine occurrences of E. nubigenum. The elevational range for this species is 4,000 to 8,000 feet.

Eriophyllum nubigenum grows in open areas on shallow rocky soils of metasedimentary origin and in gravelly or sandy granitic soils overlaying granite bedrock. Very little else is known about this species. The substrates on which this species grows are not generally considered capable of growing timber. However, commercial species may be found growing nearby.

25. Erythronium pluriflorum (Shuteye Peak fawn lily)

Erythronium pluriflorum is a bulb-forming perennial, generally restricted to granitic rocky slopes, but also found in subalpine coniferous forest where canopy closure is moderately dense. This species was first discovered on Shuteye Peak in Madera County in 1988, and appears to be restricted to a few scattered populations along Chiquito Ridge, all on the Sierra NF. The populations near Chilkoot Lake and Cold Springs Meadow are thought to be "atypical" as they are growing on the forest floor rather than in bedrock crevices and ledges where soil and humus accumulate.

26. Erythronium tuolumnense (Tuolumne fawn lily)

Erythronium tuolumnense is endemic to the Stanislaus NF. Although suitable habitat exists on the Calaveras and Groveland Ranger Districts, the species has been found only within the boundaries of the MiWok Ranger District. There are approximately 13 known locations. Eleven occurrences are on NF System Lands. The other two occurrences are on private property. The elevational range of E. tuolumnense is 1,600 to 5,000 feet.

Erythronium tuolumnense tends to grow on shady, north-facing slopes that have soils that are moist or saturated due to nearby perennial drainages, springs or seeps. The soils range from granitic clay-loams to rocky pockets of metasedimentary clays to bare granitic or volcanic rock outcrops. In all cases, there is rock on or near the surface of the soil. Most E. tuolumnense populations are found growing in chaparral, oak woodland, or ponderosa pine plant communities.

27. Fritillaria eastwoodiae (Butte County fritillary)

Fritillaria eastwoodiae occurs in Butte and Shasta Counties, mainly in or near the Plumas NF. Only one, unverified occurrence from the Lassen NF has been recorded, near Indian Creek on the Almanor Ranger District. It was recorded from the ecological survey for the proposed Indian Creek RNA, but specific location and occurrence size were not given, nor was a voucher collection made. The draft Establishment Record for the Indian Creek RNA states: "Fritillaria eastwoodiae, a Forest Sensitive species [is] relatively common in lower brushy and semi-wooded sections of the RNA." Most of the foothill habitat on the Lassen NF has not been surveyed, and additional occurrences are likely.

Fritillaria eastwoodiae grows in dry slopes in chaparral, foothill woodland, ponderosa pine, or lower mixed conifer forests. It occurs generally in filtered or partial sun. Some occurrences are on serpentine, but it is not limited to serpentine. Its elevation range is 1,200 to 3,500 feet.

This perennial herb occurs at 41 locations on the Plumas NF. It prefers dry sites, below 3,500 ft. in elevation, in open ponderosa or mixed conifer forest, or chaparral/forest ecotones. Unsurveyed potential habitat exists on the adjoining Tahoe NF, and possibly as far south as the Eldorado NF.

28. Galium glabrescens ssp. modocense (Modoc bedstraw)

This species is found on gravelly or sandy exposed slopes and under rocks on the Warner Mountain Ranger District (Modoc NF). Road construction is the primary threat that timber harvesting projects pose to this species. There are nine known locations on the Warner Mountain District.

29. Galium serpenticum ssp. warnerense (Scott Mountain bedstraw)

This plant is endemic to steep, volcanic, talus slopes. Three populations of this species have been documented on the Modoc NF in the Mt. Bidwell region of the Warner Mountains. Road construction is the primary threat that timber harvesting projects pose to this species.

30. Gratiola heterosepala (Boggs Lake hedge-hyssop)

Gratiola heterosepala ranges from central California (Fresno County) to southern Oregon, but is only known from about 20 occurrences. Five occurrences are known on the Lassen NF, on or near the Hat Creek Rim on the Hat Creek Ranger District.

Gratiola heterosepala grows on wet mud flats of vernal pools and reservoir edges. On the Lassen NF, these pools occur in eastside pine forests, sagebrush flats, and sagebrush/juniper woodlands. Associated species include Juncus spp., Eleocharis sp., Downingia bicornuta, Orthocarpus campestris, Navarretia bakeri, Gratiola neglecta, Eryngium mathiasiae, and E. alismaefolium. Generally, Gratiola heterosepala is found in relatively open mud flats rather than areas with high cover. On the Lassen NF, it is found between 3,500 and 4,700 feet elevation, but elsewhere it ranges between 65 and 5,340 feet elevation.

Specific habitat requirements which limit this species to apparently such few occurrences are not known. However, since this ephemeral annual is limited to drying mud flats, it would appear to be very sensitive to changes in hydrologic conditions in its habitat. The mud flats which contain this species are not timbered,

but harvest nearby could affect G. heterosepala habitat if increased siltation, road building, or water drafting for dust abatement occurred which would change hydrologic conditions in the habitat.

31. Horkelia tularensis (Bald Mountain potentilla)

This species is known only from three locations on the Cannell Meadow Ranger District (Sequoia NF): on the metamorphic ridgetop of Bald Mountain; at Troy Meadows; and near Jackass Meadow.

32. Ivesia aperta (Sierra Valley ivesia)

Alkaline flats and meadows including meadow/pine and meadow/sage ecotones provide habitat for this perennial herb. There are eight documented occurrences of Ivesia aperta var. aperta on the Plumas NF and four documented occurrences on the Tahoe NF.

33. Ivesia baileyi (Bailey's ivesia)

This species is known from two locations on the Plumas NF. Habitat is provided by volcanic cliffs.

34. Ivesia paniculata (Tufted ivesia)

This plant is found in gravelly rocky openings in yellow pine forests and on open volcanic ridges on the Big Valley Ranger District. Populations are affected by road building and slash piling. Eight populations are known to occur on the Modoc NF.

35. Ivesia sericoleuca (Plumas ivesia)

This species is found in alkaline flats and meadows at elevations of 4,600 to 6,600 feet in Plumas, Sierra, Nevada, and Placer Counties. There are 11 known occurrences of this species on the Tahoe NF, and 4 occurrences on the Plumas NF.

36. Ivesia unguiculata (Yosemite ivesia)

This species occurs between 5,000 and 8,000 feet elevation, often in meadows that are in poor to fair condition as determined by range analysis. Of the roughly 25 known occurrences, 20 are on the Sierra NF. New populations continue to be discovered each year during surveys in appropriate habitat, all within the currently mapped range of the species.

37. Ivesia webberi (Webber's ivesia)

Habitat for this species consists of dry barren ground in open patches of volcanic ash in sagebrush scrub, between 5,000 and 6,000 feet elevation. Ivesia webberi is endemic to Plumas and Sierra Counties (Sierra and Dog Valleys) and has yet to be found on the Tahoe NF.

38. Lewisia cantelowii (Wet-cliff lewisia)

There are 13 documented occurrences of this perennial herb on the Plumas NF. Habitat is provided by granitic, metavolcanic or serpentine outcroppings, usually along or near perennial streams. Lewisia cantelowii is also found on the Tahoe NF but is not considered a species of concern on that forest due to a lack of conflict with timber management activities.

39. Lewisia congdonii (Congdon's bitterroot)

This species has a notably disjunct distribution, occurring in both the Kings and Merced River drainages. It is a semi-succulent, thick-rooted perennial, found on rocky cliffs and talus slopes where seepage occurs in the spring.

There are seven occurrences of L. congdonii, one on the Stanislaus NF, five on the Sierra NF, and one on the Sequoia NF. The occurrence on the Stanislaus is on the Groveland Ranger District. Occurrences of L. congdonii range in elevation from approximately 1,600 to 7,000 feet. It is possible that more occurrences of this species could be found because there are areas of suitable habitat which have not yet been surveyed.

Lewisia congdonii occupies shallow soil pockets and cracks on metasedimentary rock outcrops and cliffs. It is also known to grow on granitic rock outcrops and cliffs. Very little else is known about the habitat of this species.

40. Lewisia serrata (saw-toothed lewisia)

This species is endemic to the American River watershed, ranging from several scattered locations on the Tahoe NF between the North and Middle Forks of the American River, to 11 locations on the Eldorado NF between the South and Middle Forks of the American River.

Habitat for this perennial herb is provided by steep, metamorphic bedrock outcrops with northerly aspects at elevations of 2,850 to 4,700 feet. Plants are typically found in the inner gorges of perennial streams, although a few occurrences are found near seeps and intermittent streams. Relatively high humidity is often listed as a key habitat attribute, due to the frequent presence of the species in the "mist zone" of waterfalls. This correlation is in need of further study to determine if the plants require higher ambient humidity, or just greater access to summer moisture.

41. Lupinus citrinus (Golden annual lupine)

This annual lupine occurs between 2,000 and 5,000 feet elevation in the foothills and lower coniferous forests of Fresno and Madera Counties. Thirty four of the approximately 50 known populations occur on the Sierra NF south of the San Joaquin River. Typical habitat is edges of and gravelly shelves of granite outcrops, in very exposed, treeless areas. However some populations extend into forested areas, where logging activities during the period from February to July have impacted plants in the past. The most significant timber-related threat to the species is the construction of roads and landings in the populations.

42. Lupinus dalesae (Quincy lupine)

Lupinus dalesae is endemic to Plumas and Sierra Counties, with the town of Quincy near the center of the plant's distribution. Most occurrences are on the Plumas NF, but 16 occurrences are known from the Lassen NF, on the southeast side of the Almanor Ranger District near Yellow Creek. The vast majority of plants on the Plumas NF are found in the North Fork and Middle Fork drainages of the Feather River, with a few outlying occurrences in Sierra County in the Yuba River drainage.

Lupinus dalesae is found in openings in montane coniferous forests from 2,900 to 6,300 feet elevation, in various habitats. On the Lassen NF, it occurs mostly in openings in mixed conifers forests. Some of the openings are natural, due to shallow, rocky soils, such as on open ridges, and some openings are created, such as roadcuts and skid trails. Openings range in size from small (a few meters across) to tens of acres. Slopes range from gentle to steep, and are often south (or SW or SE) facing. Soils of Lassen occurrences are usually Holland or Deadwood Family associations from metasedimentary shale and schist. The soils are often light-colored and usually rocky.

The vegetation with L. dalesae is generally an open mixed conifer forest, with Pinus ponderosa, Pseudotsuga menziesii, Abies concolor, and some Pinus lambertiana in the overstory. Shrubs and herbaceous associates are various, but usually relatively sparse.

This perennial herb is known from 87 locations on the Plumas NF. Habitat is provided by open, dry slopes in mixed conifer forest, usually with phyllite or andesite soils, at elevations from 3,000 to 7,000 ft. This species is frequently found in or near managed stands of conifers, or on or near roads and roadcuts.

43. Mimulus filicaulis (Slender-stemmed or Hetch-Hetch monkey flower)

Mimulus filicaulis is an annual herb with limited occurrences in Tuolumne and Mariposa Counties. It is found scattered in the area of Hetch-Hetchy Reservoir in Yosemite National Park; in one area of private property in Mariposa County south of the Merced River; and south of the Middle Fork of the Tuolumne River on the Groveland Ranger District. There are approximately 20 known occurrences of M. filicaulis on the Groveland District. There is one occurrence on private property within the boundaries of the Groveland District. The elevational range for this species is 3,000 to 5,500 feet. Because surveys for this plant are incomplete and suitable habitat is fairly common on the Groveland Ranger District, more occurrences of this species are likely to be found.

Mimulus filicaulis occurs in moist soils near seeps, springs, meadows and drainages. It also occurs on sites that dry out substantially in the summer but have high soil moisture in the spring. Most occurrences have been observed growing under full sun or slightly filtered light conditions. Soil type and depth do not appear to be limiting.

44. Mimulus pygmaeus (Egg Lake monkeyflower)

Occurrences of M. pygameus are limited to four general areas: near Lake Almanor, the Pine Creek drainage, Egg Lake, and southern Oregon. The first two areas contain the majority of occurrences and plant numbers, and are on the Almanor and Eagle Lake Ranger Districts, respectively, of the Lassen NF. Egg Lake is on private land near the Modoc NF, and Oregon occurrences are on BLM, Forest Service, and private lands. Eight occurrences are known near Lake Almanor (Plumas County) and another 18 or so are known from the Pine Creek area (Lassen County). Lake Almanor occurrences have been monitored periodically and appear stable. Most of the Pine Creek and vicinity occurrences have been discovered in recent years, so long-term trends are not known.

Although there are differences of associates in the plant communities occupied by M. pygmaeus at the four areas, some factors are constant. At all sites, M. pygmaeus grows chiefly in full sun and on clay soil. It occurs in vernally flooded shallow swales or mud flats flanking the channels of small streams through nearly level meadows, or on the cutbanks of of stream channels, where the floating seeds previously lodged in bare or lightly shaded places. The plants are also found in low spots in meadows where bare clayey sites have developed along drainage areas. At the Almanor site, M. pygmaeus occurs in openings within a westside ponderosa pine forest, with Lotus purshianus, Linanthus harknessii, Deschampsia caespitosa, D. danthonoides, Navarretia intertexta and others. At Pine Creek occurrences, Mimulus pygameus is usually associated with silver sage (Artemisia cana) in big sagebrush or low sagebrush flats, in eastside pine forests. Associates include Carex exerta, Achillea lanulosa, Viola beckwithii, Navarretia bakeri, and Plagiobothrys sp. Elevations range from 3,600 to about 5,870 feet for Lassen NF occurrences. Most occurrences are out in the flats away from the treeline, but some occurrences or parts of occurrences are within or near the forest.

45. Monardella stebbinsii (Stebbins' coyote mint)

This species is known from only three locations on the Plumas NF, on steep, unstable talus slopes in the North Fork Feather River drainage.

46. Navarretia prolifera ssp. lutea (Yellow-bur navarretia)

This highly localized subspecies is restricted to to a narrow east-west band 18 miles long and 8 miles wide centered over Pollock Pines, El Dorado County, California. Within the 144 square mile areas described above there are 77 documented occurrences of this annual herb. About half of these occurrences are located on federal land, the remainder are found on private lands. Over 40 percent of the known occurrences are found within three miles of the town of Cedar Grove.

All of the occurrences of N. prolifera ssp. lutea occur in openings in mixed conifer forest dominated by ponderosa pine, incense cedar, sugar pine, and California black oak at elevations of 2,420 feet to 5,000 feet on gentle slopes with aspects of south to west. These non-forested openings where N. prolifera ssp. lutea occurs may be natural openings that result from thin soils, or they may be due to human disturbances such as logging activities, road building, or housing development. On disturbed sites, the displaced vegetation may return and reduce the suitability of the site to for N. prolifera ssp. lutea, resulting in the decline in numbers and area occupied by N. prolifera ssp. lutea and its possible elimination from the site. No plants have been found in pine needle or oak leaf duff.

47. Nemacladus twisselmannii (Twisselmann's nemacladus)

Habitat for this species consists of dry granitic gravels in open stands of Jeffrey Pine at Pine Flat and near White Dome in the Domeland Wilderness (Sequoia NF).

48. Orcuttia tenuis (Slender orcutt grass)

Orcuttia tenuis is limited to vernal pools in northern California. The genus Orcuttia is believed to have been much more abundant in the Central Valley of California before agriculture and urbanization eliminated numerous vernal pools. Orcuttia tenuis is limited to about 40 occurrences, from Sacramento to Siskiyou Counties. Seven occurrences are known on the Lassen NF, five on the northern part of the Hat Creek District and two on the Almanor Ranger District. No other occurrences are known on National Forest land. Lassen NF occurrences are disjunct from the nearest occurrences in the Sacramento Valley by about 40 air miles, and are over 2,000 feet higher in elevation. Because of the geographic separation, Lassen NF occurrences may well have a different genetic make-up than the Sacramento Valley occurrences. No genetic comparison of plants from the different locations has been done.

Orcuttia tenuis is found only in vernal pools which hold water long enough to "drown out" most competition, especially introduced plants, and supply Orcuttia's physiological requirements for prolonged inundation followed by a period of gradual dessication. The Lassen NF pools containing Orcuttia typically cover from 5 to 100 acres and are formed by volcanic lava flows. The soils are generally heavy, volcanic clay. Although the vernal pools generally hold 12 inches or more of standing water in the winter and early spring, the pools have largely evaporated dry by early summer. The soil shrinks as it dries, forming large, deep cracks.

The surrounding vegetation is generally a yellow pine forest, with white oak, juniper, and buckbrush. The vernal pools generally have a sparse to moderate cover of Eryngium mathiasiae, Psilocarphus brevissimus, Eleocharis sp., Juncus sp., Grindelia sp., Navarretia bakeri, and Boisduvalia sp.

49. Oreonana purpurascens (Purple mountain parsley)

This plant typically occurs on open ridgetops in red fir and lodgepole forests, often on northeastern aspects, on the Sequoia NF.

50. Penstemon personatus (Closed-throated beardtongue)

Penstemon personatus is known from a limited number of occurrences in Butte and Plumas Counties, mostly on or near the Plumas NF. Most of the occurrences are located in the Bucks Lake area, but isolated occurrences are also known from other areas of the Oroville, Greenville, La Porte, and Quincy Ranger Districts of the Plumas NF. Two occurrences are known from the south edge of the Lassen NF on the Almanor Ranger District in the Discovery Creek area.

There are 20 documented occurrences of this perennial herb on the Plumas NF. Habitat for this species is provided by mixed conifer or red fir forest, usually with metavolcanic soils, between 4,000 to 6,000 ft. elevation.

On the Lassen NF, occurrences are found from about 5,600 to 6,000 feet elevation. Occurrences are found in red fir forests with sparse understory. Associates include Abies magnifica, Castanopsis sempervirens, Carex rossii, Pyrola picta, Kelloggia galioides, Chimaphila menziesii, and Apocynum pumilum. Plants are found both in openings and shaded forest areas within the occurrences. Soils are metavolcanic in origin, with a high organic content. Slopes are moderate to gentle, and more or less north facing (although not exclusively).

Specific factors limiting distribution for this species have not been identified.

51. Phacelia stebbinsii (Stebbins' phacelia)

This annual herb is found only in the American River Watershed between the North and South Forks of the American River. There are 29 documented occurrences, with 10 occurrences on the Foresthill Ranger District of the Tahoe NF, and 19 occurrences on the Georgetown and Pacific Ranger Districts of the Eldorado NF. Additional locations are likely to be discovered (Jokerst 1985) based on the presence of many acres of suitable habitat in the inner gorges of the American River and its tributaries.

Habitat for P. stebbinsii consists of dry, open, rocky areas on moderate to steep slopes, usually in association with bedrock outcrops, on ledges and slopes with rubble or talus, at elevations between 2,000 and 6,800 feet. The distribution of P. stebbinsii is not strongly correlated with aspect, though southerly aspects are more commonly observed than northerly aspects. Conflicts with timber management objectives are mostly limited to the proposed road and landing construction.

52. Raillardiopsis muirii (Muir's raillardella)

This mat-forming perennial occurs in Fresno and Tulare Counties on the Sierra and Sequoia NFs, and also in the Santa Lucia Mountains of Monterey County. Of the 11 occurrences on the Sierra NF, 2 are in the wilderness and the remainder are found on CAS designated lands south of Wishon Reservoir. Plants are usually found growing in very rocky or gravelly openings in yellow pine or mixed conifer forest, not in areas supporting merchantable trees. The most likely harm that could be done to populations would be skidding or road building, and the sites are generally so rocky or inaccessible as to preclude these activities.

53. Sedum albomarginatum (Feather River stonecrop)

Sedum albomarginatum is distributed on scattered serpentine areas in Butte and Plumas Counties, mainly on the Plumas NF in the Feather River drainage. Only one occurrence is known from the Lassen NF, covering about 20 acres and containing an estimated 1,000 plants. This occurrence is on the southwestern edge of the Forest in the Yellow Creek area of the Almanor Ranger District. There are 12 documented occurrences of this species on the Plumas NF.

Sedum albomarginatum grows in serpentine rock cliffs, outcrops, and slopes in mixed conifer forests. Often, its microhabitat is shaded part of the day, either by trees or other rock outcrops. Its elevation on the Lassen

NF is about 4,100 feet. It occurs on both east and west facing slopes, generally in very steep areas. Associates on the Lassen NF include Pinus ponderosa, Calocedrus decurrens, Phlox diffusa, Eriogonum sp., and Penstemon deustus. Other sensitive species in the general area are Arabis constancei and Senecio eurycephalus var. lewisrosei.

Not all factors limiting distribution for this plant have been identified, but its apparent restriction to serpentine areas explains its rarity on the Lassen NF, where such habitat is very limited.

Sedum albomarginatum has not been observed on disturbed sites on the Lassen NF. In the absence of more specific information on minimum numbers and occurrences needed to sustain viability and response to disturbance, a conservative approach is appropriate.

54. Senecio eurycephalus var. lewisrosei (Cut-leaved butterweed)

Senecio eurycephalus var. lewisrosei is distributed on serpentine areas in Butte and Plumas Counties, mainly in the Plumas NF. Two occurrences are known from the Lassen NF, on the southwest edge of the Forest on the Almanor Ranger District, near Yellow Creek and Grizzly Creek. One occurrence has plants scattered over about 400 acres, while the other covers about 150 acres. There are 14 occurrences of this species on the Plumas NF.

Senecio eurycephalus var. lewisrosei grows in serpentine influenced soils and rocky areas in mixed conifer forests. Its habitat requirements are apparently less restrictive than the other two sensitive serpentine species, since it extends to serpentine influenced soils and is not limited to serpentine rock outcrops. Common associates include Pinus ponderosa, Abies concolor, Calocedrus decurrens, Pseudotsuga menziesii, Arctostaphylos viscida, Ceanothus cuneatus, Rhamnus californicus, Iris hartwegii, and Carex multicaulis. Senecio eurycephalus var. eurycephalus is also present. Other sensitive species in the area of the Yellow Creek occurrence are Arabis constancei and Sedum albomarginatum. Senecio eurycephalus var. lewisrosei is more abundant and covers a larger area than the other two sensitive species. It is found on slopes from gentle to moderate, and all aspects.

Senecio eurycephalus var. lewisrosei is found on both undisturbed and disturbed areas, such as old road cuts, roadsides, skid trails, and at the edges of burn piles. However, it is not more visibly abundant in disturbed than undisturbed areas and its presence near some roads is probably more an indication of its midslope preference than roadside preference.

55. Silene invisa (Hidden-petal campion)

The range of S. invisa consists of a single occurrence in northeastern Trinity County, and a discontinuous band of occurrences from Shasta County south to Stanislaus County.

Occurrences of S. invisa are predominately found in and adjacent to mature and old-growth red fir forest stands. It is found along the upland margins of alder thickets, meadow edges, ephemeral stream banks, and forest edges, typically under a 40-55 percent crown closure of the red fir and lodgepole pine forests, as well as mesic sites in mature western white pine/white fir forests, rocky outcrops, manzanita/holodiscus rock garden areas. The elevational range of this perennial herb is 6,000 to 8,000 feet. Silene invisa frequently occurs where snow drifts accumulate and persist until late in the season (Taylor and Palmer 1983). Duff layers are thin or absent, and almost never greater than 1 inch. Silene invisa is typically found on 20-40 percent slopes, but occasionally on gentle (5-15 percent) or steeper (40-65 percent) slopes. The vast majority of occurrences are located on slopes with northerly aspects. Midday and afternoon shade is a critical habitat attribute for this species.

On the Eldorado NF, there are 115 known occurrences distributed over the eastern portion of El Dorado and Amador Counties, and the northern portion of Alpine County. New occurrences continue to be discovered,

primarily by Forest Service field personnel, e.g. 18 new occurrences were discovered by Eldorado NF personnel during the 1992 field season.

There are three documented occurrences of this herb on the LTBMU, all three being located near the southern boundary of the LTBMU adjacent to the Toiyabe and Eldorado NFs.

Silene invisa was first discovered in Lassen Volcanic National Park (LVNP) in 1957. It has been recorded from only five locations in LVNP, two of which have not been found in recent decades. No occurrences were known on the Lassen NF before 1991, when three occurrences were discovered in the Rice Creek area. The next closest occurrences are on the south side of the Plumas NF.

This perennial herb has been found at 46 locations of the Plumas NF. Habitat consists of moist areas, near creeks, lake edges in red fir,

On the Stanislaus NF, there are approximately 65 known occurrences. These occur on the Calaveras and Summit Ranger Districts. Occurrences on the Stanislaus National Forest have all been at elevations at or above 8,000 feet.

56. Trifolium bolanderi (Bolander's clover)

Bolander's clover occurs in montane meadows in conifer forests, and is restricted to the Sierra NF and Yosemite NP. This legume has been found growing in meadow-type habitats within stands of timber, although plants are largely restricted to open, meadow habitats which are generally avoided by timber harvesting activities. Trifolium bolanderi is predictably found at about 6,000 to 7,000 feet elevation. Forty three of the 50 known occurrences are on the Sierra NF.

57. Trillium ovatum ssp. oettingeri (Salmon Mountain wakerobin)

This member of the lily family is found in Shasta, Siskiyou, and Trinity Counties on or near the Shasta-Trinity and Klamath NFs. It is found mostly in the McCloud, Pit, and Salmon River drainages. No occurrences are currently known from the Lassen NF, but Shasta-Trinity occurrences are within one mile of Lassen NF administered land. Suitable habitat exists on the Lassen NF in the Screwdriver and Rock Creek areas of the Hat Creek Ranger District. Most of this area has not been surveyed for sensitive plants.

Habitat for T. ovatum ssp. oettingeri is described as moist, shady riparian zones in heavily forested areas on northern exposures. Elevations range from 4,000 feet to at least 6,400 feet. Canopy and brush layer shading is critical for T. ovatum ssp. oettingeri, with most occurrences having 60 percent or greater cover. It is found on slopes from flat to steep, but generally occurs on gentle to moderate slopes. Associates include Pseudotsuga menziesii, Abies concolor, A. magnifica, Acer circinatum, Amelanchier pallida, and various herbaceous species.

58. Vaccinium coccinium (Scarlet huckleberry)

There are 46 documented occurrences of this shrub on the Plumas NF. Habitat for this species consists of moist flats and slopes between 3,500 and 6,000 feet in elevation, in mixed conifer forest.

B.II. GENERAL CONSIDERATIONS FOR EFFECTS ANALYSIS FOR SENSITIVE PLANTS

1. INTRODUCTION

This section, basically developed by Region 1 botanist Steve Shelly and revised and modified for use in Region 5, provides guidelines for analyzing the potential effects of timber harvest/management activities and their alternatives on occurrences of sensitive plants. An effects analysis is a part of the biological evaluation process, and is required in cases where sensitive plants have been found within or near proposed project areas.

Currently, there are 58 plant taxa (species, subspecies, or varieties) included on the Region 5 sensitive plant list that are known to occur on Sierran forests in habitats where timber harvesting activities could be prescribed. Each taxon is different with respect to critical life history characteristics, habitat requirements, and ecological sensitivity. In addition, the extent of knowledge concerning these factors varies greatly among these many plants; for some taxa, there is exhaustive information regarding their geographic distribution, biology, and/or habitat requirements, while for others virtually nothing is known.

Consequently, it is extremely difficult, and potentially misleading, to generalize about how to analyze the effects of various management activities on all of these taxa. Species with populations that occur in proposed project areas should therefore be evaluated on a case-by-case basis. In many situations, some research (literature review and/or field studies) will need to be conducted, in order to obtain information on a species life history, autecological requirements, geographic distribution and status, etc. Thus, the aims of this biological evaluation will be to provide: 1.) information on critical biological, ecological, and geographical factors, 2.) guidelines for conducting effects analysis for sensitive plants, 3.) types and sources of information and data available and 4.) selected references.

a. Overview of Sensitive Plants in the Sierra Nevada Province

Sensitive plants in the Sierra Nevada are basically all endemic to one or more of the national forests or adjacent lands within this physiographic province. However, endemism itself does not explain rarity or sensitivity to land management activities. A review of the sensitive plants in the Sierra Nevada is important, because an effects analysis should include an assessment of both the local and rangewide significance of any occurrences located in proposed project areas.

Endemics: These are species that are confined to a relatively small geographic area, and often to one particular specialized habitat within that area. Two types of endemics are found in the Sierra Nevada, narrow endemics (those restricted to very small geographic areas), and regional endemics (species that occur in somewhat larger geographic areas, and whose range may extend into one or more adjacent forests. An example of a narrowly endemic species is Erythronium pluriflorum (Shuteye Peak fawn-lily), a member of the lily family that is known only from Chiquito Ridge, Sierra NF. An example of a regional endemic is Silene invisa (short-petaled campion), a species in the carnation family that is found on several Sierran forests.

Generally, sensitive plants on Sierran forests are known from fewer than 15 occurrences. Several sensitive plants are known from fewer than 10. These sensitive plants can be located all within a watershed or mountain range (giving the perception of being more common than they actually are from a global perspective), to widely scattered occurrences that may be separated by more than 50 miles. Distribution is a very important criterion in evaluating species viability.

2. CRITICAL ASPECTS OF PLANT SPECIES BIOLOGY, AUTECOLOGY, AND GEOGRAPHY

One of the obvious, but important, ways in which plant occurrences differ from many animal populations is in their immobility. Small shifts in occurrence boundaries can occur over relatively short time spans, especially

for annual species, but in general a plant occurrence will occupy a discrete, relatively stable area on the landscape. Thus, unlike sensitive animal species, the individuals in a sensitive plant occurrence are much more vulnerable to the direct, physical impacts of management activities. There are a number of factors that have bearing on the significance of such impacts and resultant occurrence responses. These factors can be grouped into three main categories: A.) plant species biology (at the individual, occurrence, and species levels), B.) the autecological characteristics of the species, and C.) the geographic distribution of the occurrences, at local, regional, and rangewide scales.

a. Plant Species Biology

Most of the factors concerning plant species biology involve research questions beyond the scope of a project-level effects analysis. The summary of factors below is presented mainly to indicate the types and complexities of desirable information.

An understanding of the biology of a particular species is crucial to ensuring its preservation (Massey and Whitson 1980). Wherever possible, informed management decisions should ideally include consideration of the following factors (adapted from Huenneke et al. 1986):

1) Individual Level
- a) life history (i.e., annual vs. perennial, monocarpic vs. polycarpic)
- b) mode of reproduction (i.e., asexual (vegetative) vs. sexual)
- c) breeding system (i.e., self-compatible, outcrossing, or both)
- d) pollination biology, and other mutualistic relationships

2) Population Level
- a) presence of a seed bank, and the existence of dormant stages
- b) degree of genetic variation within the population(s)
- c) population ecology, including effects of herbivory and disease
- d) viable population size (a largely undetermined standard for plants)

3) Species Level
- a) degree of genetic variation among the populations or occurrences.

b. Autecological Characteristics

It is important to point out the potential usefulness of all types of ecological information, including not only that obtained through detailed quantitative studies, but also qualitative field observations on the part of the field botanist conducting the analysis.

The ecological characteristics for plants on the Region 5 sensitive plant list vary widely. Some of the properties that might have bearing in an effects analysis include:

1) habitat requirements (these requirements may be very specific, or more general)

2) nature of the species response to human-caused disturbance (tolerant vs. intolerant)

3) seed germination and seedling establishment requirements

4) nature of the species response to natural events, i.e., fire, succession

c. <u>The Geographic Distribution of Populations</u>

The geographic distribution of the populations of a sensitive plant is a very important consideration when conducting an effects analysis. Disjunct or peripheral occurrences may contain genetic variation that is not present in occurrences that are within the core of a species range; maintenance of these occurrences may be important for ensuring the retention of the evolutionary adaptability and potential of the species. Fortunately, there is often fairly good information available regarding the geographic distribution of occurrences. Specific factors that should be addressed include:

1) The number and size of occurrences, at local (project), regional, and rangewide levels; is the species a geographically restricted endemic, or is it peripheral or disjunct in the project effect area? Are the populations very sparse throughout the range of the species, occurring only in isolated areas containing specific, suitable habitat; or are the populations more evenly distributed, in common habitats?

2) The historical geographic distribution, and the history of rarity (i.e., is the species a neoendemic (recently evolved), or is a population a disjunct relict of a formerly wider range?)

3) The local (project-level) pattern of distribution of the occurrences across the landscape (i.e., divided into adjacent, very close subpopulations; sparsely scattered individuals; populations widely separated from one another). This factor addresses metapopulation structure (i.e., the relationship of populations to landscape features, ecosystem dynamics, and habitat patches).

The geographic aspect of effects analysis will be addressed in more detail below.

An excellent technical review of these and other plant traits that influence population viability analyses is provided by Menges (1991). These traits are listed below, and the reader is referred to this reference for details:

1) neighborhood size (typically small for plants)

2) disturbance ecology

3) microsite specialization

4) phenotypic plasticity

5) clonal growth

6) spatial aggregation and metapopulations

7) resource generality and niche definition

8) size

9) cryptic phases in life history (i.e., dormancy)

10) mutualisms (i.e., with pollinators or dispersers)

11) diversity in breeding systems and life history

12) potential for selfing

13) effects of inbreeding on genetic stochasticity

3. GUIDELINES FOR CONDUCTING EFFECTS ANALYSES FOR SENSITIVE PLANTS

This section provides a framework for analyzing the effects of proposed actions at the project level on sensitive plant occurrences. The process is highly iterative; refinement of the available information and resultant analysis is likely to continue throughout the procedure.

In the presentation of this outline, it is assumed that the analyses would be conducted or reviewed by journey-level botanists who have a basic knowledge of the pertinent taxonomic and ecological literature, detailed knowledge of the flora of the area, and experience in conducting project reviews and status surveys for sensitive plant species through the NEPA process.

a. Review of Available Information

The first stage of an analysis consists of a review of all available information concerning the distribution, ecology, population biology, etc., of the sensitive plant species concerned. The scientific literature should be searched, including both published and unpublished references. In addition, the pertinent state Natural Heritage Programs should be consulted for locational data and other information regarding the species. A summary of the information review should be presented at the beginning of the effects analysis.

b. Determining and Prioritizing Cause and Effect Components

Numerous factors may cause a response, beneficial or negative, to a sensitive plant occurrence. These factors include direct physical impacts to occurrences, the alteration of habitats adjacent to these occurrences, and the occurrence or suppression of fire.

Below is a listing of general project types, followed by examples of the direct and indirect effects, both beneficial and adverse, that can result from them:

1) Road Construction
a) direct removal of individuals, subpopulations, or the entire population (subsequently reducing overall numbers and, possibly, population or species viability).
b) promotion of exotic plant invasion along disturbed corridors
c) alteration of surface and/or subsurface hydrology
d) dust, or siltation of aquatic habitats
e) easier access of habitats to livestock
f) population fragmentation

2) Timber Harvesting
a) direct removal of individuals, subpopulations, or the entire population
b) alteration of the light regime (i.e., understory is more exposed to sunlight)
c) increased soil erosion into riparian zones or wetlands
d) disruption of ecological relationships (i.e., mycotrophism)

e) change in successional stage of associated vegetation
f) alteration of surface and/or subsurface hydrology
g) population fragmentation
h) change in evapotranspiration rates
i) change in wind patterns
j) promotion of weed encroachment

3) **Livestock Grazing**
a) direct impacts to individuals, subpopulations, or the entire population
b) change in successional stage of associated vegetation
c) increased soil erosion
d) enhancement of weed establishment and infestation in heavily grazed areas
e) trampling of fragile soil features (i.e., cryptogamic soil crusts)
f) changes in surface and subsurface hydrology

4) **Mining**
a) direct impacts to individuals, subpopulations, or the entire population
b) promotion of weed encroachment
c) population fragmentation
d) alteration of soil chemistry (especially important when habitats of edaphic endemics are involved)

5) **Recreation**
a) direct impacts to individuals, subpopulations, or the entire population, i.e., by trail construction and use
b) taking of plants by wildflower enthusiasts
c) introduction of competitive weeds, i.e., through use of contaminated stock feed

6) **Fire Suppression**
a) changes in successional stage (towards advanced stages)
b) increased interspecific competition (denser vegetation cover)

7) **Occurrence of Fire**
a) stimulation of reproductive output and establishment (due to reduction in interspecific competition)
b) changes in successional stage (towards early stages)

All of the above causes and subsequent effects may also result in changes in population biology, including pollinator relationships, the genetic structure of the occurrence, and seed dispersal patterns.

In order to assess the **cumulative effects** of habitat loss resulting from past, present and reasonably forseeable actions, the analysis needs to be conducted over the widest geographic scale possible. If analyses are conducted strictly at the project level, the overall significance of potential effects will be obscured. See the following section, regarding analysis spatial limits, for suggested guidelines on this aspect of analysis.

c. **Determination of Spatial and Temporal Limits of the Analysis**

1) **Spatial Limits**

In order to conduct a complete analysis of the effects of a proposed action on a sensitive plant occurrence, it is important to address several different geographic scales. Specifically, the analysis should include a summary of the species distribution on all of the following levels:

a) global range of the species
b) statewide range of the species
c) distribution and status of the species on a National Forest
d) distribution and status of the species within and near the proposed project effect area

Information on the total range of the species is needed in order to ascertain the overall importance of the occurrence. For example, a peripheral or disjunct occurrence may be very important in maintaining the overall geographic structure of the species. All occurrences of an endemic species may be important in maintaining rangewide viability. If these large-scale patterns are not included in the analysis, the significance of the population may be diminished or obscured. However, a complete rangewide distribution summary is often unavailable, or is difficult to obtain for some parts of the species range. Reference to state and regional floras, and to the Natural Heritage Program, can be used to gain a more complete picture.

At the state level, the status of a species is often more readily available, from appropriate Natural Heritage Programs. Information on the numbers and locations of population occurrences can be obtained. These data can be used to assess current status, and to guide additional field inventories.

At the National Forest level, information on the size, numbers, and distribution of the occurrences is important for assessing the significance of the potential impacts over a narrower geographic area.

At the project level, information on the size and areal extent of the occurrence, both inside **and** outside the proposed project boundaries, is needed. In cases where occurrence numbers can be obtained, a numerical assessment of the potential effects can be made. Such data can be obtained only by thorough field surveys in all potential habitats in and near the project area. Depending on the habitat specificity of the species, and the extent of suitable habitat in the area, a sensitive plant survey may be quite small in some cases, or very large in situations where suitable habitat is extensive.

One of the most frequent questions encountered in determining the spatial limits of an analysis lies in defining the "population." Plant species are very rarely distributed randomly across the landscape, but sort out into appropriate habitats (microsites) as smaller subpopulations or occurrences. For purposes of effects analysis, it is adequate to consider adjacent subpopulations (colonies of plants growing in proximity, i.e., within one air mile of each other, and often lying within the same drainage and/or on the same aspect) as part of the same occurrence. The critical aspect of the analysis is not so much the definition of a "population", but the complete delineation, through thorough field surveys, of the locations and size of each occurrence, within and outside the proposed project area boundaries. Such delineation is desirable in order to numerically assess the significance of the proposed impacts. Depending on the number of individuals in each occurrence, and the percentage of these that will be impacted or removed in specific areas, mitigation measures can be devised to avoid or minimize direct and indirect effects. This approach addresses the concept of the metapopulation.

2) Temporal Limits

In cases where sensitive plants are found directly within proposed impact areas, the physical impacts would obviously be immediate. However, many plant species may be more susceptible to longer-term residual effects, beyond the time of completion of activity. Shifts in habitat suitability due to successional changes, or slow changes in hydrology, are examples of such effects. Unfortunately, the exact impacts of these residual effects is largely unknown for many species,

and field observations of several occurrences must be relied upon to make the most informed assessment possible.

Some plant species display a favorable response to habitat disturbance. In these cases, the disturbed habitat (i.e., a roadbank) mimics the natural habitat. However, in such cases, this ruderal response does not imply long-term population persistence; these sites may frequently be re-disturbed, and the plants repeatedly impacted. They may eventually becoming destroyed through this action. Also, the overall abundance of such species may be low, and the establishment of a few plants in a disturbed habitat probably does not contribute to the long-term viability of the species.

In summary, owing to the variability in life history, ecology and disturbance tolerance of sensitive plant species, the temporal extent of the analysis will vary on a species- and project-level basis. Professional judgment, based on existing data, is required.

d. Describing the Existing Condition

A complete description of the existing condition is crucial to a sufficient analysis. Although there is not a large body of literature concerning field survey methods for sensitive plants, a few references are available.

At a minimum, two aspects of occurrence condition should ideally be displayed in the effects analysis. The first should be, where practical, an outline of the occurrence size, both within and outside the project effect area. These data can provide an indication of the extent to which the occurrence will be affected, i.e., the percentage of the occurrence that would be impacted. Secondly, a map showing the occurrence boundaries, or those of subparts if appropriate, should be included; it should show the occurrence in relation to the project boundaries (i.e., road locations, proposed sale units, etc.). Such a map could also be included in the main body of the Biological Evaluation, or in the project file. This graphical display can be useful in evaluating the potential effects of the project on the overall occurrence or metapopulation structure and to address potential effects of habitat fragmentation.

e. Predicting Effects

The prediction of effects is the most difficult aspect of conducting analyses for sensitive plants, because there is generally little detailed information on the ecology or population dynamics of so many species. However, there are some methods available to assist in gathering information or quantitative data. These include demographic monitoring studies, experimental studies, and consultation with experts.

Approaches to demographic monitoring are numerous. Monitoring studies can provide extremely detailed information regarding changes in occurrence size and structure; however, they are usually labor-intensive. They also generally require a longer time period, usually at least several years, in order to obtain adequate data to assess or predict trends. Once the data are available, though, they can provide a means of assessing population viability.

Experimental studies provide another means of assessing the potential effects of management activities. Also, previously established "experiments" (i.e., prior land management activities) may provide insights into plant occurrence responses, such as the persistence or loss of individuals in a clearcut). In cases where proposed project effects have been largely mitigated, but the loss of some individuals will take place, establishment of monitoring plots in disturbed and undisturbed habitat can provide information for future, similar situations.

Consultation with experts is also a means of obtaining information that can be used to assess potential effects. A good starting point is to contact the appropriate state Natural Heritage Program. Botanists in these programs can often provide the names of systematists or ecologists familiar with a particular species, or they may have already conducted research or field surveys on it themselves.

In some cases, extremely useful information can be obtained through literature review. The Natural Heritage Program, or experts that are consulted, may be able to provide published and unpublished references.

Often, though, there will simply not be any substantial information available for some species. In these situations, it is important to remain conservative in predicting effects and prescribing mitigation measures. In general, while the loss of a few individuals may be deemed insignificant, it will generally be very important to maintain the overall geographic structure of the occurrence and its component subpopulations. The maintenance of occurrence and subpopulation "distribution viability" should serve as a good stand-in for maintaining less easily-observed features that affect the viability of the species, i.e., genetic variation patterns, pollinator relationships, seed dispersal patterns, and gene flow within and among occurrences. An important, emerging concept in conservation biology, concerning metapopulation structure and dynamics, can be used to address this "distribution viability." A metapopulation is defined as "...a collection of interdependent populations affected by recurrent extinctions and linked by recolonizations" (Murphy et al. 1990). An excellent review of the importance of metapopulation structure to the maintenance of population viability is provided by Gilpin (1987). The importance of metapopulations is also summarized by Rohlf (1991).

The existence of many populations is critical for species that inhabit patches in a shifting mosaic of habitats. Multiple populations also serve as a source of colonists and thus as a hedge against environmental stochasticity. And, metapopulation dynamics are likely to become increasingly important as habitat areas become fragmented. Thus, the maintenance of metapopulation structure will most adequately allow the population to withstand land management effects (as well as future natural habitat changes). This approach is especially useful in light of the fact that the quantitative viability threshholds for plant populations are unknown for most species.

f. Documentation

The final analysis documentation should include:

1) summary of the pre-analysis literature/information review

2) personnel conducting field surveys and follow-up analyses

3) results of field surveys, including qualitative and quantitative observations (some of this will have been covered in the body of the biological evaluation):
   a) if occurrence censuses were completed, a tabular outline of occurrence/suboccurrence sizes should be included
   b) a discussion, preferably referencing a map, presenting the distribution pattern of the potentially affected occurrence
   c) any other pertinent observations on the biology or ecology of the species

4) delineation of the available alternatives and their predicted effects on the sensitive plant occurrence(s); include the "no action" alternative as a basis for comparison

5) a conclusion, which presents the effects prediction (no effect, may have beneficial effect, may adversely affect, or not likely to adversely affect). In the case of a "may adversely affect" prediction, and whenever appropriate in a "not likely to adversely affect" situation, the associated biological evaluation should include mitigation recommendations to avoid or minimize impacts.

6) bibliography of references and experts consulted

7) copies of appropriate field survey forms, maps, etc.

8) the disposition of supporting materials (voucher specimens, photographs, etc.)

9) correspondence with USFWS.

g. Results of Consultation with USFWS

This should include a phone log for informal conversations with USFWS personnel, the Biological Opinion if it was required, or a letter of concurrence from USFWS with the Forest Service determination of effect in all cases other than "no effect".

h. Determination of Analysis Intensity

Some factors influencing the intensity of field surveys for sensitive plants are summarized by Nelson (1985). These factors, and summaries of the survey intensity under each circumstance, are summarized below:

FACTOR	MORE INTENSIVE SURVEY NEEDED	LESS INTENSIVE SURVEY IS ACCEPTABLE
Direct physical impacts	In areas that will be disturbed	Areas not planned for disturbance
Plant Community	In communities known to support sensitive species	Community types known not to support rare plants
Vegetation Density	Dense vegetation types, tall canopies and thick understory types that restrict visibility	Open vegetation types with good visibility
Plant Visibility	Known or suspected sensitive plants are of very small size, coloration that is difficult to see, etc.	Plant characteristics that are easily noticed

These factors are outlined here strictly as general guidelines. The level of analysis intensity involves a professional judgment on the part of the botanist. The most important factor influencing analysis intensity will be the nature and extent of the impacts from a proposed project. As emphasized earlier, it will also often be important to expand the area of analysis outside the project effect area.

4. SOURCES OF INFORMATION

A variety of sources of information regarding the biology and distribution of sensitive plants may be consulted during an effects analysis. The following list describes these sources.

a. Floras (state and regional) and other published scientific literature.

b. Previously prepared environmental impact statements and rare plant survey reports.

c. Previously prepared status reports on particular species.

d. Herbarium collections.

e. Knowledgeable persons.

f. The state Natural Heritage Program, which contain the computer-assisted inventories of the locations and status of rare plants and plant communities. The locations are also mapped on USGS topographic maps.

5. SUMMARY

Since detailed demographic and life history information for potentially affected sensitive plant species will often be lacking, a professional judgment by the botanist, based on the best available information, will be needed. The key considerations, when these detailed data are not available, will be 1) **ecological response**, 2) **geographic distribution**, and the 3) **timing**, **intensity** and **frequency** of the proposed actions.

Important ecological considerations include, but are not limited to:

a. **the relationship of the species to vegetation succession** under various disturbance regimes

b. **the sensitivity of the habitat relationship** (i.e., is the species highly restricted to one soil type [= edaphic endemism] or unique, vulnerable habitat [bogs, fens, seepage areas, etc.], or is it less specific in its requirements [occurring in more common, "resilient" habitats?).

Important geographic considerations, as reviewed earlier are aimed primarily at the retention of the "distribution viability" of the species (i.e., whole populations, or subpopulations and occurrences where the species has a patchy distribution in the analysis area). This approach should serve as a reasonable substitute for maintaining underlying population and metapopulation structure, genetic variation patterns, demographic processes, and other less-easily analyzed aspects of population viability. Numerical summaries of population and subpopulation size can be useful in providing an indication of the extent of potential impacts. In general, however, heavy reliance on numerical analysis of population size should be avoided, since the quantitative threshholds for viability are unknown for most species. The task of assessing the probability of adverse effects will remain a matter of professional judgment in most cases.

Monitoring of known populations, by periodic field checks (to determine overall trends in the number of populations) and detailed population-level demographic studies (to assess the effects of management activities), will be increasingly important in the production of good effects analyses. Such monitoring is best conducted by Ranger District and National Forest staff.

In the future, the development of conservation strategies for individual species, or sets of species that share a common habitat, will be emphasized in Region 5. Where these are available for a potentially affected species, the project-level biological evaluation/effects analysis should be based on the recommendations in the conservation strategy.

B.III. DETERMINATIONS OF EFFECT

ANALYSIS OF THE POTENTIAL EFFECTS OF TIMBER HARVESTING ON FEDERALLY LISTED THREATENED, ENDANGERED, AND PROPOSED PLANT SPECIES

1. Introduction

This section of the BE analyzes the potential effects of timber management and related activities on Federally listed T&E plant species in the Sierra Nevada Province. There is only one Federally listed species in the Province, Mahonia sonnei Abrams. This endangered species is also listed by the Regional Forester as sensitive and by the State of California as endangered (USDA Forest Service 1990).

2. Consultation

Informal consultation between the Tahoe National Forest botanist (Kathy Van Zuuk) and the USFWS botanist (Jan Knight) was conducted in July 1992. During a telephone conversation, the USFWS concurred that avoidance of known and discovered occurrences of M. sonnei would result in a determination of "no effect."

A further informal consultation took place in a telephone call between Diane Macfarlane of the FS and Jan Knight of USFWS on August 5, 1992. The nature and extent of salvage harvest activities was discussed and specific wording for project design standards was agreed upon.

3. Current Management Direction

Applicable policy, as shown in the Forest Service Manual (FSM 2671.45), is to conduct a prefield review of available information, and in instances where there is no evidence of species or habitat, "document the findings of the biological evaluation in the decision notice when an environmental assessment has been prepared (FSM 1950). If an action is excluded categorically from preparation of an EA or EIS, document the findings in the unit files and proceed with the proposal." The following is direction found in affected Forest Plans:

Lake Tahoe Basin Management Unit

Forestwide Standards and Guidelines from the Lake Tahoe Basin Management Unit Land and Resource Management Plan (1988) include the following: "The primary purpose [of Management Practice 18] is to assure that existing habitat of [sensitive] plants is adequately protected and that additional habitat is provided to perpetuate the species." (P. IV-28)

Tahoe National Forest

Management direction in the Tahoe National Forest Land and Resource Management Plan (1990) for endangered species states: "Use recovery plans as the template for managing threatened and endangered species." (P. V-8) Forestwide standard and guideline 23 (p. V-28) states: "Modify or exclude activities not compatible with survival of threatened or endangered species." This standard and guideline also says to "(p)rotect known populations of Mahonia sonnei."

Protection of M. sonnei is further facilitated through implementation of the Forest standard and guideline for riparian areas, which precludes timber harvesting from within 200 feet of perennial streams.

4. Description of Proposed Project

This section of the BE is not being written in response to a site-specific proposal for timber management and associated activities. The intent is to provide a BE that will identify which design standards will be used to reach a determination of "no effect" on M. sonnei when and if a timber sale is proposed in the known and/or suspected range of this species.

Project Design Standards for M. sonnei

The following two design standards will be implemented for all timber timber sales in the known and/or suspected range of M. sonnei:

a. Designate the one transplanted occurrence of M. sonnei as a Controlled Area if and when its habitat is included within a sale area. Flag and avoid the area and buffer as prescribed by the Forest Botanist.

b. Conduct surveys of all project areas with potential to provide habitat for M. sonnei prior to the signing of a decision notice or decision memo, and avoid all impacts to M. sonnei. The Forest Botanist will determine how avoidance will be accomplished and the dimensions of any needed buffers.

5. Existing Environment

The existing environment refers to all the elements of habitat that are potentially affected by the proposed project for species or habitats of concern.

Mahonia sonnei [Berberis sonnei] (Truckee Barberry)

A habitat capability model for M. sonnei has not been prepared. The factors responsible for the limited distribution of this species have not been identified. The following description of suitable habitat is based on an analysis of the one known, naturally occurring population of M. sonnei.

The one naturally occurring population of M. sonnei consists of five plants located along the Truckee River in Truckee, California. These plants occur together on a site located approximately 30 to 50 feet from the edge of the Truckee River. These plants are in the partial shade of the following tree and shrub associates: black cottonwood, mountain alder, western chokecherry, and wild rose. The elevation of this site is about 5,700 feet.

Habitat for M. sonnei consists of rocky banks in montane riparian communities found along permanent watercourses, often on or near sagebrush dominated benches or other gently sloping sites above the lower banks of perennial streams.

A second population of M. sonnei has been artificially established by transplanting 14 individuals to an area located about 1/4 mile below Prosser Dam. These plants were propagated in a private nursery and then transplanted in 1988 by the USDI Fish and Wildlife Service. Less than half of the transplanted individuals now survive. The cause of mortality has not been determined, but it is suspected that the drought conditions that have persisted since the plants were transplanted is the primary cause of death.

There are two historical occurrences of M. sonnei, neither of which have been relocated in recent years despite efforts to do so by the California Native Plant Society, the Fish and Wildlife Service, M. Y. Williams, and the Forest Service (Van Zuuk, personal communication). These unverified occurrences were both reported to be on the Truckee Ranger District of the Tahoe National Forest; one near Soda Springs and the other near the headwaters of Deer Creek.

The amount of unsurveyed, potential M. sonnei habitat has not been tabulated. This is largely due to a lack of knowledge concerning the precise habitat requirements of the species. Most of the identified potential habitat for this species is located along the Truckee River and has been surveyed by Forest Service personnel with negative results.

No critical habitat has been identified as part of the recovery plan for this plant (p. 37, FWS 1984). The delineation of critical habitat will be developed at a later date pending the outcome of the following: studies on the taxonomy of the species (there remains doubt as to the taxonomic validity of this species) and monitoring of transplanted individuals.

6. Effects of the Proposed Project

The one naturally occurring population of M. sonnei is not located on National Forest System land. The one transplanted occurrence would be designated as a Controlled Area (Project Design Standard No. 1), if and when its habitat is included within a sale area, and will not be entered for the purpose of recovering dead and dying conifers. Thus, both known occurrences of this endangered plant species are protected from potential effects of salvage logging operations.

In addition, unsurveyed potential habitat for this species does not occur on commercial timber lands. The implementation of standards and guidelines for riparian areas will avoid impacts to any undiscovered occurrences of M. sonnei. To ensure the adequacy of these standards and guidelines, surveys of all potential habitat areas for M. sonnei included within a proposed project area must occur prior to the signing of a decision notice or decision memo, and all potential impacts must be avoided (Project Design Standard No. 2).
Implementation of the design standards listed above will result in a determination of "no effect" to M. sonnei.

7. Determination

Provided that future timber sales in the known and/or suspected range of M. sonnei follow existing management direction as described and the corresponding project design standards, it is my determination that such activities will not affect the species or its habitat.

8. Literature Cited

Federal Register. Volume 55, Number 35. 1990.

Lake Tahoe Basin Management Unit Land and Resource Management Plan. 1988.

Mickelson, Keith. Personal Communication. 1992

Tahoe National Forest Land and Resource Management Plan. 1990.

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USDA Forest Service. 1992. Biological Evaluation for Drought Related Timber Salvage on National Forests of the Sierra Nevade Province, PSW Region, CY 92 & CY 93.

USDI Fish and Wildlife Service. Recovery Plan for the Truckee Barberry. 1984.

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ANALYSIS OF THE POTENTIAL EFFECTS OF TIMBER MANAGEMENT ON REGION FIVE SENSITIVE PLANT SPECIES

1. Introduction

The differences between the various alternatives to manage forest ecosystems which contain California spotted owls in the Sierra Nevada Province are not site-specific enough to evaluate what impacts may occur to the sensitive plant resource.

Due to the extremely site specific nature of sensitive plant occurrences throughout the Sierra Nevada, no accurate determination of effects can be made between the various alternatives developed in this Environmental Assessment. Therefore, this document can serve only as a foundation for project level BEs that can be attached by reference. This BE also provides a process by which timber management activities can be designed to achieve determinations of "no impact" or "may impact individuals but not likely to result in a trend toward Federal listing or a loss of viability."

2. Current Management Direction

Forest Service policy for sensitive plants as stated in the Forest Service Manual (FSM 2670.32) includes the following:

a. Avoid or minimize impacts to species whose viability has been identified as a concern.

b. If impacts cannot be avoided, analyze the significance of the potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.

c. Establish management objectives for Federal candidate species.

Definitions

a. **Viable populations** are defined as "(A) population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range within the planning area." (FSM 2670.5)

b. **Potential habitats** are areas that are thought to possess the ecological factors required to support a given sensitive plant species based on the interpretation of aerial photographs, topographic maps, and other resource aids such as vegetation and soil resource inventories.

c. **Suitable habitats** are those areas that have been surveyed by botanists and have been confirmed to possess the physical and biological attributes necessary to support the given sensitive plant species.

Current Management Direction for Sensitive Plant Species by Forest

Management direction is subject to change, and may alter the level of analysis needed to complete the biological evaluation process. This is especially true for Category 1 candidate plant species, some of which may be proposed for listing under the Endangered Species Act during the next 2 years. Category 1 candidate species are defined by the USDI Fish and Wildlife Service as "(t)axa for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species" (Federal Register 1990).

The following are specific policy statements in existing Land and Resource Management Plans (LRMP) for national forests in the Sierra Nevada Province.

a. Eldorado National Forest

The goal of the Forest sensitive plant program is to maintain viable populations of sensitive plant species, and under Management Practice 49, the General Direction is to "(p)rovide for protection and habitat needs of sensitive plants so that Forest activities will not jeopardize the continued existence of such species." [Land and Resource Management Plan (LRMP) 1989]

Additional direction is provided by the following excerpt from the LRMP, "Sensitive plant species and potential sensitive plant habitats are managed to ensure that species do not become threatened or endangered because of Forest Service actions. Inventoried plant locations are recorded in the resource data base but omitted from public map display to protect them. Forest managers and project designers have access to this plant information in order to check locations against project boundaries. Sensitive plant disturbance is thereby avoided." (P. 2-14)

b. Lake Tahoe Basin Management Unit

Forestwide Standards and Guidelines from Lake Tahoe Basin Management Unit Land and Resource Management Plan (1988) include the following:

"The primary purpose [of Management Practice 18] is to assure that existing habitat of [sensitive] plants is adequately protected and that additional habitat is provided to perpetuate the species." (P. IV-28)

c. Lassen National Forest

Management direction for sensitive plants is found in the Lassen National Forest Land and Resource Management Plan (LRMP, final version to be released, unsigned, July 1992. Record of Decision is scheduled to be signed in September 1992). Forest Goals and Standards and Guidelines for the Sensitive Plant program follow (LRMP p. 4-26 and 4-27).

> Maintain habitat and viable populations to contribute to eventual de-listing of sensitive plants that are found on the Forest.
>
> 1) Identify, preserve, or enhance sensitive plant populations.
>
> 2) Restrict vegetative or soil disturbance in areas occupied by sensitive plants, unless manipulation is needed to perpetuate the species.
>
> Manage Sensitive plants to insure that species do not become Threatened or Endangered because of Forest Service actions.
>
> 1) Evaluate all proposed projects for potential sensitive plant habitat. Conduct surveys at the correct time of year for species identification if potential habitat exists in a project area.
>
> 2) If sensitive plants are found in a proposed project, modify the project or take mitigative action as necessary to protect the habitat.

d. Modoc National Forest

Direction and Guidelines from Modoc National Forest Land and Resource Management Plan (1992) and Final Environmental Impact Statement (1992) include the following:

"All sensitive plant locations are managed according to the policy direction of the Forest Service Manual (FSM 2670) and the R-5 handbook on threatened and endangered species. Where known populations or sensitive plant habitats exist on the Forest, a botanical survey is conducted prior to any land disturbing or land exchange activity. Survey procedures and finding are documented in project environmental analysis records. Projects are modified to maintain the integrity of the habitat." (P. 3-61, FEIS)

Manage and conserve sensitive plant species and their habitats to ensure that viable populations are maintained.

Develop and implement a consistent, systematic, biologically sound program for sensitive plant species and their habitat so that federal listing as threatened or endangered is unnecessary.

"The Forest will conserve sensitive plant populations by identifying and protecting their specific habitats" (p. 3-25).

"Prior to project implementation, conduct inventories if potential habitat or known population locations are identified." (P. 4-21).

"Allow no new disturbance of identified sensitive plant habitat without an environmental analysis." (P. 4-21).

e. Plumas National Forest

Interim Management Prescriptions (Plumas National Forest 1991)

Astragalus lentiformis

Recommendation : No more that 10 percent of each population on the Forest may be impacted by land disturbance activities and will be monitored to assess the effect of management activities on the species. At least 90 percent of each population will be protected.

Ivesia aperta
Ivesia sericoleuca

Recommendation: Use one of the following prescriptions in the draft Multiforest Interim Species Management Guide:

Rx #1. Total plant protection will be recommended.

Rx #2. In some cases a portion of a population can be impacted. This is determined after consultation with the Forest Sensitive Plant Coordinator and/or Forest Botanist.

Lupinus dalesae

Recommendation: Monitor land disturbance activities to document the effects. Gather information on the habitat characteristics of existing occurrences including potential impacts. From that information, establish protected population areas to maintain the genetic, geographic and habitat variety within the species until the results of the monitoring are known.

Penstemon personatus

Develop regulated timber management prescriptions for timber harvest, fuels treatment, site preparation and release that maintain viable population levels in species locations. Protected population areas will be established within the occupied habitat to maintain geographic and genetic variety within the species. The regulated prescription may occur throughout the occupied habitat except in the protected population areas. Limited inventory of potential protected population areas must be accomplished at the onset. Ongoing inventory and botanical investigation will occur. Management activities that enhance or don't alter the characteristic for which the reserve (protected population) location was chosen may occur.

Senecio eurycephalus var. lewisrosei

Recommendation: No more than 25 percent of each population found on the Forest may be impacted by land disturbance activities. These activities will need to be limited to those that will not eliminate the species. Monitoring will occur to assess the effect of management activities on the species.

Silene invisa

Recommendations: The viability of the species will continue to be maintained if standards and guidelines for drainages and meadows are followed and if unique occurrences are maintained.

Unique occurrences include those found associated with old-growth forests, those growing on or at the base of rock outcrops, and other unusual situations (plants growing in old skid trails and clearcuts are not necessarily considered unique). Each occurrence found outside of a meadow/drainage habitat will be evaluated separately in consultation with the Forest Botanist to determine if its uniqueness warrants protection from ground disturbing activities. A fifty foot buffer will typically be required in situations where a unique occurrence is found.

Vaccinium coccinium

Recommendation: No more that 25 percent of each huckleberry population found on the Forest may be impacted by land disturbance activities and no more than 10 percent of the huckleberry found on the Forest can be eliminated by land disturbance activities. Monitoring will occur to assess the effect of management activities on the species.

Arabis constancei
Astragalus webberi
Fritillaria eastwoodiae
Ivesia baileyi
Ivesia webberi
Lewisia cantelowii
Mondardella stebbinsii
Sedum albomarginatum

Protect all plant locations.

f. Sequoia National Forest

The Sequoia National Forest Land and Resource Management Plan (1988) provides the following management direction (p. 4-28): "Protect sensitive... [plant species] with the long-term objective for removal from Federal listing or to prevent them from being listed."

"Known populations of sensitive plants and their essential habitats will be protected..." (p. 4-50, Final Environmental Impact Statement for Sequoia National Forest Land and Resource Plan).

g. Sierra National Forest

Current Sierra National Forest direction is to develop and implement management practices to ensure that sensitive plant species do not become listed as threatened or endangered because of Forest Service actions. In the interim, sensitive plant surveys are to be performed and any necessary protection incorporated into the planning of each ground-disturbing project.

Specific direction is given in the Standards and Guidelines of the Draft LRMP, which commits the Forest to "manage sensitive plant species to avoid future listing as threatened and endangered" and to "ensure maintenance of genetic and geographic diversity and viable populations." (S&G 68, p. 4-17)

h. Stanislaus National Forest

The Stanislaus National Forest Land and Resource Management Plan [(LRMP), 1991] mandates that "the Forest will conserve sensitive plant populations by identifying their specific habitats and minimizing their disturbance." (P. III-118) General direction for management of Sensitive Plants under the LRMP is to "provide for protection and habitat needs of sensitive plants, so that Forest activities will not jeopardize their continued existence." Direction in the LRMP standards and guidelines is to "modify planned projects to avoid or minimize adverse impacts to sensitive plants." (P. IV-76)

i. Tahoe National Forest

Management Direction and Guidelines in the Tahoe National Forest Land and Resource Management Plan (1990) include the following (p. V-8):

"Provide enough quality habitat so that the Forest's sensitive species will not become threatened or endangered."

3. Existing Environemnt for Species of Concern

To the extent practical in a programmatic BE, species accounts for species of concern are given above in Section II.C. Detailed descriptions of historical information, reproductive success, recent survey efforts, and relative distributions of the species of concern in the proposed project areas must be provided with field analysis beyond this outlined programmatic review of this EA. Similarly, descriptions of sensitive plant habitat quality, quantity, and configuration must also be provided at the project level. Discussions of this nature are well beyond the scope of this document and need to be prepared in response to specific projects.

Sensitive plants exist in a dynamic environment, and accurate descriptions of species accounts, habitat status and occurrence today will vary from descriptions provided in 1993. This is due to the effects of management activities such as logging and road building, as well as natural stochastic events such as fire and continued mortality in many stands of conifers. Line officers need accurate assessments of the status of sensitive plant species in proposed project areas in order to ensure that sensitive plants "receive full consideration in the decision making process" (FSM 2672.41). This type of information is best provided by project specific BEs.

4. Effects

The effects of timber management and associated activities in coniferous stands on sensitive plant species is a function of many variables, including: 1) the harvest prescription employed, e.g. tractor vs. cable vs. helicopter; 2) the season that the harvest prescription is employed; 3) the intensity of the activity; 4) the

duration of the activity; 5) the species of concern present in the activity area; 6) the management practices utilized to minimize or avoid impacts to the species of concern; and 7) the effects of recent and foreseeable management activities in the analysis area. Thus, an analysis of effects can only be made in response to site specific proposals that describe the six variables listed above. This discussion of effects needs to give careful consideration to the "No Action" alternatives, especially with regard to how the No Action alternatives differ from the Action alternatives in terms of fuels and fire risk.

Based on the analysis within this EA, there is no accurate way to determine what effects may be influenced by these alternatives. Since sensitive plants occupy very small and localized sites on the landscape, analysis of harvest and/or associated activities will need to occur on a case-by-case basis through project level assessments.

5. Determination

This biological evaluation has provided an overview of the process to determine what effects on sensitive plant species may occur by implementing any of the proposed alternatives in this EA through projects that may include these guidelines. Botanists and/or Forest Sensitive Plant Coordinators will need to make project specific determinations in supplements to this programmatic biological evaluation. Selection of one of the alternatives in the accompanying EA should not result in a trend toward Federal listing for any sensitive species provided that appropriate design standards and mitigation are included in specific project proposals during implementation as determined by site specific BEs.

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Sub-Appendix C/A

TIMBER SALE CONTRACT PROVISIONS
C(T) 6.25
and
C(T) 6.313

C6.25# - Protection of Habitat of Endangered Species. (10/78) Location of areas needing special measures for protection of plants or animals listed as threatened or endangered under the Endangered Species Act of 1973 and R-5 Sensitive Plant and Animal Species List are shown on Sale Area Map and identified on the ground. Measures needed to protect such areas have been included elsewhere in this contract or are as follows:

(List special protection measures needed.)

If protection measures prove inadequate, if other such areas are discovered, or if new species are listed on the Endangered Species List, Forest Service may either cancel under C8.2 or unilaterally modify this contract to provide additional protection regardless of when such facts become known. Discovery of such areas by either party shall be promptly reported to the other party.

In the event of contract modification under this Subsection, Purchaser shall be reimbursed for any additional protection required by the modification, provided that any work or extra protection required shall be determined by Forest Service using standard Forest Service rate redetermination methods in effect at time of agreed change and shall be in the form of a reduction in Current Contract Rates unless agreed otherwise in writing. However, in no event may Current Contract Rates be reduced below Base Rates.

Instruction: Include in all new contracts and existing contracts at time of extension.

C6.313# - Limited Operating Period. (1/84) Except when agreed otherwise, Purchaser's Operations shall be limited as follows:

(insert)

Instructions: Use if cut-off dates or other limitations on Purchaser's Operations are needed to coordinate with fire closures, seasonal recreation, construction, wildlife breeding or nesting seasons, etc. Not to be used to countermand second paragraph of B6.31.

Sub-Appendix C/B

Sensitive Plant Field Surveys

SENSITIVE PLANT FIELD SURVEYS

I. TYPES OF FIELD SURVEYS

A. **Target Surveys:** Surveys for a particular species, in which the specific habitat for that species is the focus of the field work. During the course of targeted field work, the botanist should document all areas surveyed, whether the species was found or not. Target surveys usually combine studies of previously documented sites, searches for historical records, and coverage of previously unsurveyed habitat. This is the approach used to determine the endangerment status of a species; it often results in the preparation of a report on the statewide or rangewide status of that species.

B. **Floristic Surveys:** Surveys of a particular area for the presence of sensitive plant species. A species list of plants observed or collected is usually prepared. This is the approach to be used most frequently in project-level effects analyses. The presence of specific, ecologically restricted sensitive plant habitat in the proposed project area often allows the botanist to narrow the focus of the surveys during field work.

II. GUIDELINES FOR CONDUCTING SENSITIVE PLANT SURVEYS

A. **Pre-field research:** Check existing sensitive plant occurrence records, to determine if any species have been documented in or near the proposed project area (sources of such information are discussed below). With reference to the Region 1 sensitive plant field guide and pertinent floras, note these species habitat requirements, flowering characteristics, and blooming periods. Refer to available plant photographs and/or sketches as necessary. Aerial photographs are also very useful for planning and conducting field work.

B. **Conduct field surveys** during the normal growing season of the species known or suspected to occur in the project area. The best time to survey for most species is during their peak flowering period. However, it is not always possible to identify some plants from the flowers alone. In some plant families (i.e., Apiaceae, Boraginaceae, Brassicaceae, Cyperaceae, Fabaceae, etc.), it is necessary to make return visits to collect fruits and/or seeds for positive identification.

The proper timing of field surveys is **essential** to conducting a rigorous analysis that can withstand the scrutiny of other experts. If the desired project schedule does not allow for conducting surveys during the proper time of year, then the environmental assessment will be deficient with respect to sensitive plants.

There are situations where even a thorough, well-timed survey might not reveal the presence of certain species in the project area. For example, many annual species can be sporadic in germination from year to year depending on yearly climatic conditions. Thus, an analysis conducted during an adverse year may not detect such species. In the case of many annual species, either the plants do not grow, or they appear in much-reduced numbers, during unfavorable growing seasons. The only solution to such difficulties is to conduct surveys in more than one season in the most suitable habitat areas. Visiting other known occurrences is a valuable technique in documenting whether a particular annual species has appeared during the current field season. This problem also underscores the idea that, as Nelson (1985) states, "...a rare plant survey cannot deny a species existence, it can only confirm it."

C. **Special habitats** that occur within the project area, and which could thus contain sensitive species, should always be surveyed. Such habitats include, but are not limited to:

1. riparian areas

2. wetlands (bogs, fens, and marshes)

3. seepage areas

4. wet or dry meadows

5. dry, open slopes

6. rock outcrops, especially of unusual soil types

7. rocky banks and cliffs

A botanist should not expect to complete a detailed survey of much more than 150-200 acres in one day. The total acreage surveyed in a single day will be determined by terrain, amount of special habitat present, the degree of plant species diversity in the area, and the number of positive sightings of sensitive species.

III. FIELD SURVEY METHODS

A more detailed review of the two basic field search methods is provided by Nelson (1985).

An often-used search pattern is the "random meander." In this approach, the botanist primarily searches areas that contain apparently suitable sensitive plant habitat; the method is based on professional judgment and intuition, and requires extensive field experience and knowledge of the species that are known or suspected to occur in and near the project area. The problems encountered using this approach include lack of certainty about which areas have been covered, and possible lack of coverage of the entire project area.

The second method involves the use of transects, in which a series of regularly-spaced traverse routes are used to survey the entire project area. The transects in this case serve only as a guide, though; they do not have to be perfectly straight, as in many techniques that are used for quantitative vegetation sampling. They also do not have to be permanently marked; often, though, stakes or flags may be useful to help visualize the approximate traverse route to be followed during each pass.

A floristically-based, semi-quantitative meander approach is described by Goff et al. (1982). This method, which is called the "floristic site examination," provides information to document the level of effort expended during the survey, and provides a description of the floristic resources of the site. The methods are briefly summarized here:

A. **Delineation of field units.** The botanist separates the project area into different search units based on the habitat types present. This helps ensure coverage of the entire range of vegetation variability.

B. **Seasonal distribution of effort.** The timing of sampling is scheduled so that the sensitive species likely to be encountered in each habitat are as fully identifiable as possible at the time of sampling. The surest approach includes resampling of each field unit several times during the growing season.

C. **Timed meander search procedure.** Within each field unit, the botanist selects a point of entry, and the time of beginning the examination is recorded. All species are recorded on a field data form as they are encountered; those whose identity is uncertain are recorded as unknowns and are collected for later keying. The transect meanders as the botanist attempts to cover all habitat variation in the field unit. The meandering transect may double back over previously covered ground, follow a zig-zag pattern, or take any other form, so long as maximum coverage of floristic variation within the field unit

is provided. For example, upon entering the field unit, several species may be recorded before moving from the starting point. Then, observation of a variation in cover several meters away from the origin leads the botanist to that point, where several new species may be recorded. Thence, a course of meander is chosen that appears most likely to yield new species. This continues, and the botanist orients the path of meander to cover all internal variation in the field unit as thoroughly as possible, until in his/her judgment no new species would be encountered with additional search effort. **The investigator's observation of and orientation toward habitat variations provides more thorough coverage than formal procedures, such as random or regular (transect) surveys.** At intervals of ± 10 minutes, the time is recorded on the data form, dividing the species list into sets of species recorded during each time interval.

Additional details regarding data summarization are provided by Goff et al. (1982).

IV. SURVEY INTENSITY LEVELS

A system of defining field survey intensity levels has been devised in Region 6. The system includes six survey levels, which are selected based on the likelihood of occurrence of sensitive plants within a proposed project area (i.e., whether the area contains any habitats known to support sensitive plant populations elsewhere). These levels are:

Level 1 = "Field Check"
The surveyor gives the area a quick survey but does not walk completely through the project area. The entire project area has not been examined.

Level 2 = "Cursory"
The surveyor walks through the project area, but the entire project area has not been examined.

Level 3 = "Limited Focus"
The surveyor closely examines one or more habitat-specific locations within the project area, but does not look at the rest of the area.

Level 4 = "General"
The surveyor gives the area a closer examination by walking through the project area and walking around the perimeter of the area, or by walking more than once through the area. Most of the project area is examined.

Level 5 = "Intuitive Controlled"
The surveyor conducts a complete examination of specific areas within the project area, in addition to walking through the area and its perimeter or walking more than once through the area.

Level 6 = "Complete"
The surveyor has walked throughout the area being examined until nearly all of the area has been surveyed.

V. DOCUMENTATION OF SENSITIVE PLANT POPULATIONS

If a sensitive plant population is located, complete documentation of the population characteristics is required. At a minimum, the following observations should be made (Nelson 1985):

A. identification (including a voucher specimen if appropriate)

B. number of plants

C. the precise location of the site

D. the exact areas covered by the population (or subpopulations); copies of a 1:24,000 topographic map, showing the overall area surveyed and specific sensitive plant locations, should be attached

E. habitat characteristics

F. phenology

G. ecological observations, including evidence of competition, pollination activities, and disturbance (fire, predation, grazing, etc.)

All of these data are important in evaluating the importance and sensitivity of the occurrence, and will contribute to a better understanding of the biology and geographic distribution of the species.

Counting the number of plants is often formidable if the occurrence is large, if the plant is very small, if it spreads vegetatively. In any event, where possible it is best to count the entire occurrence; if not possible, the occurrence should be subdivided, and the numbers and area estimated from these smaller counts.

As discussed above, it is essential to document the entire extent of the occurrence within the project boundaries. Then, in order to assess the importance of this portion of the occurrence, surveys should usually include habitat outside the proposed project boundaries since these can change or be modified based on the results of other specialist's input through the ID Team process.

Collect voucher specimens of sensitive and other plant species as needed, and as occurrence size allows (> 25 individuals present). Photographs of sensitive plants, and associated species if appropriate, should be taken; be sure to photograph both the plants and their habitats.

APPENDIX D

APPENDIX D

Timber Strata Glossary

Description of Timber Strata Affected by California Spotted Owl Management Recommendations

Selected Timber Strata

- Enter only once before final Plan
- Maintain 40 percent in largest trees

M4G Mixed Conifer, Large Tree (>23" Av. DBH), Heavy Cover (>69 percent Canopy Closure)
M4N Mixed Conifer, Large Tree (>23" Av. DBH), Medium Cover (40-69 percent Canopy Closure)
M6 Mixed Conifer, Multi-layer stand, Large Trees (>23" Av. DBH) over Pole or Small Trees (5-23" Av. DBH), Heavy Cover in understory (>69 percent Canopy Closure)
P4G Ponderosa Pine, Large Tree (>23" Av. DBH), Heavy Cover (>69 percent Canopy Closure)
P6 Ponderosa Pine, Multi-layer, Large Trees (>23" Av. DBH) over Pole or Small Trees (5-23" Av. DBH), Heavy Cover in understory (>69 percent Canopy Closure)

Includes:

- All mixed conifer stands with over 23 inches average DBH and at least 40 percent canopy cover

Other Timber Strata

- Enter only once before final plan
- Maintain 30 percent in largest trees

M2G Mixed Conifer, Pole-size Tree (5-11" Av. DBH), Heavy Cover (>69 percent Canopy Closure)
M3P Mixed Conifer, Small Tree (12-23" Av. DBH), Light Cover (<40 percent Canopy Closure)
M3G Mixed Conifer, Small Tree (12-23" Av. DBH), Heavy Cover (>69 percent Canopy Closure)
M4P Mixed Conifer, Large Tree (>23" Av. DBH), Light Cover (<40 percent Canopy Closure)
R3P Red Fir, Small Tree (12-23" Av. DBH), Light Cover (<40 percent Canopy Closure)
R3N Red Fir, Small Tree (12-23" Av. DBH), Medium Cover (40-69 percent Canopy Closure)
R4G Red Fir, Large Tree (>23" Av. DBH), Heavy Cover (>69 percent Canopy Closure)
R4N Red Fir, Large Tree (>23" Av. DBH), Medium Cover (40-69 percent Canopy Closure)
P4N Ponderosa Pine, Large Tree (>23" Av. DBH), Medium Cover (40-69 percent Canopy Closure)
P3G Ponderosa Pine, Small Tree (12-23" Av. DBH), Heavy Cover (>69 percent Canopy Closure)
P3N Ponderosa Pine, Small Tree (12-23" Av. DBH), Medium Cover (40-69 percent Canopy Closure)

Includes:

- Mixed conifer stands with pole-size trees and at least 70 percent canopy cover
- Mixed conifer stand with 12-23 inches average DBH and any amount of canopy cover

Source for above is R-5 FSH 2409.21B, AMEND 2, 11/87, CH 300 as modified for consistency with the CASPO report, Table 1C.

APPENDIX D

Available Acres for Timber Management

	Alt. 1	Alt. 2 1/	Alt. 3 2/
Plumas	898.9	849.7	493.5
Lassen	622.3	596.3	392.1
Tahoe	528.5	506.4	317.9
Eldorado	307.6	294.6	205.9
Sierra	328.9	317.3	247.1
Stanislaus	328.5	314.5	194.3
Sequoia	237.0	234.8	173.2

1/ Although CAS lands remain the same, the protected activity centers decrease acres that typically would be harvested.

2/ Although CAS lands remain the same, the typical exclusion of green timber harvest from owl use acres, causes the acreage reduction.

APPENDIX D

Recent Timber Sale Program Information

Volume Offered (Mar 17.0) in million board feet

Forest	'92 MAR		'91 VOL	'90 VOL	'89 VOL	AVE '89-'91
	Target	Proj.				
Eldorado	171.5	157.2	162.5	232.9	173.1	189.5
Lassen	102.5	42.8	110.6	172.5	175.8	153.0
Plumas	216.8	94.9	120.2	207.4	198.6	175.4
Sequoia	93.4	1.3	85.7	67.2	62.2	71.7
Sierra	80.0	46.5	83.0	123.7	134.1	113.6
Stanislaus	119.6	64.6	120.8	122.8	120.9	121.5
Tahoe	145.1	34.9	28.1	102.6	131.1	87.3

Volume Harvested

Forest	'91 VOL	'90 VOL	'89 VOL	AVE
Eldorado	167.85	186.36	189.51	181.24
Lassen	116.99	132.48	168.32	139.26
Plumas	242.82	208.05	196.12	215.66
Sequoia	69.89	55.74	60.18	61.94
Sierra	96.98	155.72	166.53	139.74
Stanislaus	108.62	154.19	185.90	149.57
Tahoe	95.37	129.94	128.45	117.92

From TSPIRS Rpts. '89-'91

APPENDIX D

Forest Insect and Disease Information

Dwarf mistletoes

Dwarf mistletoes are obligate parasitic plants, each species of which is specific to only certain host-conifer species. Over 2.8 million acres (21%) of commercial forest land in California is infested with dwarf mistletoe, resulting in annual growth and mortality losses of 122 million cubic feet (Johnson, 1992). Dwarf mistletoe is the most serious disease affecting ponderosa and Jeffrey pine, infecting 26% of the pine type in California, Washington and Oregon (Bolsinger, 1978). This disease ranks second in importance to annosus root disease as the most damaging disease of white fir, affecting 30% of all white fir (California Forest Pest Control Action Council, 1960).

Losses from this pest are due to reduced height and diameter growth of moderately to heavily infected trees, reduction in value due to poorer wood quality and increased mortality of heavily infected trees. Tree mortality is most often caused by the combined effects of mistletoe and cambium-feeding insects. Additional stress factors such as overstocking and drought increase the likelihood of mortality. During drought periods, mistletoe infected trees are usually the first to die. During the 1976-79 drought, 50-75% of the pines that died were infected with dwarf mistletoe (Byler, 1978; unpublished data, Forest Pest Management).

Many of the severely infected stands we now see in the Sierra are the result of past selective logging practices in which infested overstory trees were either overlooked, or purposely left as undesirable commercially, resulting in infection of the subsequent understory. Sanitation and salvage harvests in mature stands for the express purpose of reducing mistletoe infections rates have not been effective. In fact, repeated sanitation and salvage cutting creates the multiple-aged conditions which can favor the spread of dwarf mistletoe (Barrett, 1979).

Selection harvest also creates multiple or uneven-aged conditions which promote spread of mistletoe (Barrett, 1979). Because dwarf mistletoe is a long-lived obligate parasite which spreads horizontally at a rather slow rate (average 1-2 feet per year), it is best adapted to survive and flourish in an uneven-age stand with a high proportion of susceptible hosts in both the overstory and understory. Thus, in mistletoe-infested stands, any silvicultural system such as single tree selection, group selection, shelterwood or seed tree, which intermixes generations of susceptible host trees, will favor dwarf mistletoe infestation.

Generally, shelterwood and seed tree systems don't pose a significant risk of infecting the understory (unless infected overstory trees are intentionally retained), because the overstory is removed before the understory is large enough to become infected. However, under uneven-age systems, such as individual tree and group selection, where the future stand is continuously exposed to the currently infected overstory, infection of the new stand is assured and future growth loss and mortality will result. At the worst, the new stand may be prevented from ever reaching merchantable size and years later will have to be destroyed if the site is to be made productive (Smith, 1978).

Where stands are heavily infected with mistletoe, regeneration harvests which remove the source of infection provide the only effective means for eliminating the disease and establishing healthy stands.

The following excerpts provide more details on this disease:

- Hawksworth, Frank G. Intermediate cuttings in mistletoe-infested lodgepole pine and southwestern ponderosa pine. In: Proceedings of the Symposium on Dwarf mistletoe control through forest management, April 11-13, 1978, Berkeley, California. Pacific Southwest Forest and Range Experiment Station, Forest Service, USDA, General Technical Report PSW-31, pages 86-92.

> Many studies have shown that dwarf mistletoes are stimulated by opening up stands by thinning. We also know that the effects of dwarf mistletoe are less pronounced in more vigorous trees, so the beneficial effects of thinning will be evident in increased growth rates, despite the fact that mistletoe might also increase. However, thinning can not be recommended in heavily infested stands. We do not know exactly when a given stand is too heavily infested to thin, but we tentatively suggest that thinning be confined to stands with a DMR (dwarf mistletoe rating) of 3 or less.

- Scharpf, Robert F., and Parmeter, J. R., 1967. Spread of Dwarf mistletoe into Jeffrey Pine Plantation... trees infected after 22 years. Pacific Southwest Forest & Range Experiment Station, USDA, Forest Service, Research Note PSW-141, 6 pages.

> Distance of spread of dwarf mistletoe in California more closely approximated that found by Roth (1953) in Oregon. He found that maximum spread from overstory ponderosa pines, averaging 120 feet tall, to understory was 130 feet in the direction of prevailing winds. Beyond 33 feet, however, infection was moderate to light. Wind probably was an important factor in long distance spread to plantation trees from adjacent infected overstory.

- Bega, Robert V., 1978. Diseases of Pacific Coast Conifers. Forest Service, USDA, Agriculture Handbook No. 521, pages 127-132.

> Unlike the true mistletoes, dwarf mistletoes are not disseminated by birds, but depend on an explosive mechanism for spread. During maturation the fruits swell with water and build up considerable hydrolic pressure. At maturity the seeds, usually one per fruit, are explosively discharged by the water pressure in the fruit. Discharged seeds may travel horizontally for 30 to 40 feet. With the aid of the wind, seeds discharged from the tops of trees may travel as far as 100 feet or more. The seeds are sticky. They initially adhere to the foliage of surrounding branches and trees. During the rain the seeds swell with water, becoming slippery, and wash down on and adhere to the host branches where germination and infection occur.

Annosus root disease

Annosus root disease caused by the fungus Heterobasidion annosum is the most important conifer root disease in California, affecting 2 million acres of commercial forest land and resulting in annual volume losses of 19.3 million cubic feet. Two strains of the fungus affect conifers, one specific to pines, juniper and incense-cedar, and the other specific to true firs. Most annosus infection is caused by colonization of freshly-cut stump surfaces by wind-disseminated spores of the fungus. In true fir, colonization of basal wounds is also a source of infection. The occurrence and intensification of both strains is greatly increased by selective cutting and uneven-age management, especially where regeneration of susceptible species on infected sites is favored, particularly true fir.

The strain of annosus which infects pine stumps moves via root contacts into the root systems of adjacent live trees and kills them by girdling the tree at the root crown. Direct mortality is often the result of bark beetle attack. This strain of the fungus may remain active for 30-50 years, passing the infection on to any conifer regeneration who's root system grows into contact with that of the infected stump, thereby rendering an infection center unproductive for an extended period of time (Smith, 1984).

The strain of annosus which infects true fir causes a decay of the smaller roots and the heartwood of larger roots and the butt, but does not, as in pine, quickly kill the tree. In fir, the result is a gradual decline (often lasting 10-20 years), resulting from decay of part of the root system and leading to windthrow, or death due to attack by fir engraver. In true fir, wounds may also be colonized by the fungus, leading to substantial decay of the individual wounded tree, but not development of an infection center (Gast, et. al, 1991).

In unmanaged stands, annosus root disease usually occurs at low levels. However, stands that have had multiple partial cut entries tend to have a higher occurrence, especially in mixed conifer stands where true fir has been cut or wounded (Gast, et. al, 1991). The incidence and impact of annosus root disease increases substantially with multiple entries, characteristic of uneven-age management systems. For example, in a study of true firs on the Fremont National Forest, Oregon:

	% infected	% killed
Unentered	12	0.04
Entered once	40	1.7
Multiple entries	100	20.8

Uneven-age management of stands with root disease present, even at infection levels as low as 5% can result in appreciable long-term yield losses. In a mixed conifer stand modeled on the Deschutes NF, total volume yield under uneven-age management was 73% of that obtained using a clearcut harvest system (Petersen, 1989).

Loss in infected stands is estimated to be as high as 75 percent of normal growth (Filip, 1982). Clearcutting of infected stands and regeneration with resistant species can reduce the future incidence of annosus and other root rots. Any silvicultural system which retains infected overstory trees including selection cutting, sanitation and salvage cutting or shelterwood harvest (unless resistant species are used for reforestation) can result in continued or increased levels of stand infection.

Black Stain root disease

Black stain root disease is caused by the fungus Leptographium wageneri. This fungus also has two strains, one affecting pines and the other Douglas-fir. Long distance spread, and initiation of new infection centers, is by insect transmission; root-feeding beetles and weevils are attracted to stressed, low vigor trees, carrying with them the spores of the fungus. The fungus infects the vascular system of the tree causing fairly rapid decline and death, often in conjunction with bark and engraver beetle attack. Tree to tree root grafts or contact result in transmission of the disease between trees within a disease center. Infection centers are often associated with management activities such as selective harvest, thinning or road construction which result in tree wounding or increased stress, or where overstocked stands predominated by pine occur. Site disturbance attracts insect vectors of the disease (Hansen, 1978).

On the Georgetown Divide area of the central Sierra, the black stain/bark beetle complex has resulted in a loss of 57,000 cubic feet of wood per year (Byler, et. al, 1979). The disease is being found with increased frequency in eastside pine stands, usually associated with thinning or soil disturbance (Kliejunas, 1992).

Decay associated with wounds

Decay associated with tree wounds is especially serious where repeated entries occur in stands of susceptible species, particularly true firs. These wounds may either activate dormant fungal infections or provide entry for fungal spores. The location of the wound determines which decay fungi gain entry and how rapidly decay occurs. Studies by Fiddler and others found that as many as 50% of the leave trees in true fir stands are wounded by conventional (no special harvest or administrative practices utilized) tractor logging procedures during partial cuts. Of those wounded, 90-100% became infected by decay fungi, resulting in board foot volume losses of 6-13% (Fiddler et al, 1989).

Therefore, uneven-age management systems, especially single tree selection which involves frequent entries and limited room for equipment manuverability, would be expected to result in a significant amount of decay due to tree wounding. Similar, and perhaps worse, results for partial cutting with cable-logging systems might be expected, because in addition to the potential for basal wounds, wounding higher up on the bole and top-breakage would likely occur with selective cable logging.

Defoliators

Defoliators may cause considerable damage and subsequent mortality in stands dominated by Douglas-fir or white fir. Of particular concern is the Douglas-fir tussock moth, which in recent years has resulted in epidemic conditions on the Lassen and Plumas forests, and the white fir sawfly. Host tree species (white fir and Douglas-fir) numbers are increased as a result of natural regeneration in mixed conifer types, especially with a light harvest, which maintains shaded conditions favorable for those species.

Fire exclusion, particularly in pine types, has also favored the establishment of dense white fir reproduction, often as an off-site species on droughty sites. These conditions contribute to increased defoliator populations and subsequent damage. The research literature on defoliators is compelling that management prescriptions utilizing even-age management (in mixed conifer) and prescribed fire are necessary for the control of defoliators. The objective of these management prescriptions is to reverse the successional trend (from one dominated by shade tolerant species back to more shade intolerant species) created by nearly a century of fire suppression and selective harvesting. The western budworm provides an example:

> Outbreaks of western budworms are always associated with late successional and climax plant communities in Douglas-fir, white fir, grand fir, and subalpine fir habitat types. Intertree competition intensifies in these types of stands, and moisture stress is accentuated because these trees are less tolerant to drought than their serial counterparts.
>
> During this century our management practices have increased the amount of the budworm's "favorite food" - the shade-tolerant conifer species. These practices have also provided many layers of shade-tolerant understory species which offer dispersing budworm larvae good sites to land and feed, plus many of these stands are under severe stress from overstocking. These conditions have reduced the probabilities of budworm larvae dispersed to the hostile environment on the forest floor reducing their chances of survival.
>
> Silvicultural practices can be used to reverse these successional trends. To be effective against the budworm, silvicultural practices must render the forest less favorable to the budworm and enable it to withstand and recover from budworm impact. Actions that make the forest less habitable for defoliaters include reducing the amount and type of food, decreasing the flight, feeding and egg-laying opportunities for the budworm, and increasing the opportunities for parasites and predators, and also altering the temperature and moisture conditions to favor tree growth and health. Actions that help the forest withstand budworm attack include increasing stand vigor by converting mature shade-tolerant forests to younger age classes that contain increased proportions of seral species. These stands can then be cultured to reduce the overall stresses of inadequate water, light, nutrients, and stocking levels.

Bark Beetles

The most destructive insect pests of California forest trees are bark beetles. Although these small insects are always present in the forest, the damage they cause is usually widely scattered and barely noticeable. However, under certain environmental conditions their numbers may increase dramatically . When this occurs frequent and widespread tree mortality may continue to occur for several years, until conditions are no longer favorable to the beetles.

Bark beetles bore through the bark of live or recently dead trees. They excavate "galleries" and deposit eggs just under the bark. As larvae hatch, they too excavate galleries by feeding, usually in the cambium of the host tree. Feeding kills the living tissue within the tree, and if severe enough can "girdle" the tree. Fungi introduced by the adult beetles can grow quickly and clog water conducting tissues, thus hastening mortality of the host.

Any condition that reduces tree vigor contributes to the ease by which bark beetles can successfully attack a tree. Smog damage, root diseases, overcrowding, and mistletoes have all been associated with higher levels of bark beetle attacks. Damage to root systems, fire scars, soil compaction and other human-induced stress also invite bark beetle attacks.

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APPENDIX D

Forest Plan Allowable Sale Quantities

Nat. Forest	ASQ (MMBF)
Eldorado	137
Lassen	96
Plumas	266
Sequoia*	75
Sierra	88
Stanislaus	88
Tahoe	129

* Mediated Settlement Agreement volume

Refer to the Glossary, Appendix A, for a definition of ASQ.

APPENDIX E

APPENDIX E-Engineering

Fiscal year 1991 construction/reconstruction information is displayed to provide the reader with a sense of the transportation program. It displays the ratio of road construction to road reconstruction and reconstruction funded by appropriated versus timber-sale generated funds. Reconstruction has positive effects to other resources, particularly the soils, watershed and fisheries resources as it is used to improve road features such as drainage and erosion control measures. Fiscal year 1991 was not a typical year, as salvage harvest (which usually involved lower value products) was most economical from existing road systems. Therefore, there was less road construction than probably would have occurred in a year with more green timber sold. The Forest Plan Current Condition is used to display the general forest transportation situation.

Most Sierran National Forests (except for the Sequoia) have road systems that nearly are completed (approximately 90 percent or greater roaded, except for areas excluded from road constructions like Wilderness and areas with Semi-Primitive Non-Motorized/Recreation designation). All Forests with a regulated timber base, even those with essentially completed transportation systems, still need some additional roading to fully access commercial timber.

Future harvest plans and timber sale activities will require necessary road improvements to comply with the spotted owl nesting seasons, road safety standards, clean air, water quality, storm discharge, and riparian Area standards and guidelines. During spotted owl nesting periods, roads may have to be reconstructed or resurfaced during fall, winter and spring seasons to provide for timber sale access (not if outside PACs or SOHAs).

	FY 91: Miles Const.	reconst.		Forest Plan Current Condition
Nat. Forest		App 1/	PC 2/	
Eldorado	4	3	5	System is essentially complete EIS p. 3-22
Inyo	0	0	0	System is essentially complete EIS p. 242
Lassen	1	0	15	System is essentially complete. EIS p. 3-6 (local road needs are minor)
Modoc	11	0	9	System essentially complete (Warner Mtn. area an exception) EIS p. 3-24
Plumas	18	0	54	System is essentially complete EIS p. 3-106
Sequoia	6	5	19	Approximately 70% of the CAS lands are roaded (personal communication-For. Eng)
Sierra	4	7	20	System is essentially complete DEIS p. 3-2
Stanislaus	3	6	23	System is essentially complete Forest Plan p. 3-139
Tahoe	3	0	13	System is essentially complete EIS p. 3-20
LTBMU	0	0	0	No regulated harvest. In some areas, harvest could necessitate roads EIS 3-17

1/ Appropriated funding

2/ Purchaser credit funding

APPENDIX F

APPENDIX F

Public Comments

This appendix summarizes the efforts of the Pacific Southwest Region to involve and consult individuals, agencies and organizations in the development of the alternatives for the California Spotted Owl Interim Guidelines Environmental Assessment. A complete record of public correspondence is available in the planning records in the Regional Office.

PUBLIC INVOLVEMENT PROCESS

Summary of the Involvement Procedure:

Regional Office

5/25/92: Public Involvement Plan developed. The public involvement plan identified the goals, objectives, target audiences, communication tools and specific action items for the preparation of an Environmental Analysis for the interim Management of the California spotted owl. Primary objectives were to communicate to all potentially affected publics, provide information and that messages shared with the potentially affected public will be clear and concise. The target audiences were agency employees, the timber industry, elected officials, Federal, State and Local Agencies, environmental groups, other interest groups and the general public.

5/27/92: Conference call with affected Forest Supervisors and their staff to discuss interim guidelines and to help them communicate with their publics.

Week of 5/25/92: Meeting set up for June 8, 1992 with key representatives from the timber industry in the morning, and environmental group in the afternoon.

Also, a Federal Register Notice was prepared which discussed the scope of the analysis and solicited public input. The Notice was published in June 1992.

5/28/92: ID Team Leader phone communication with Lawrence Whitfield, WFIA, who requested copies of Dr. Noon's habitat model be sent to two other timber industry representatives. IDT spoke to Dr. Noon and requested he talk to Mr. Whitfield directly, as there was some confusion about exactly what Mr. Whitfield needed.

6/2/92: ID Team Leader phone communication with Sami Yassi, representative of NRDC to discuss scope of analysis. Mr. Yassi discussed the HCA concept and requested this be considered as an alternative.

6/3/92: Mass mailing of information to affected/interested key publics. Over 300 letters mailed. Packages contained a cover letter soliciting input, a copy of the Federal Register Notice (which was also mailed that day), and a copy of Chapter 1 of the CASPO Report.

6/8/92: Meeting held with timber industry representatives. The meeting was attended by 18 representatives of the timber industry, the Regional Forester, Deputy Regional Foresters, and the California Spotted Owl Interim Guidelines Team. Objectives of the meeting were to inform the group of the environmental analysis process involved with establishing interim guidelines for the owl, and to request input on preliminary objectives, issues, and alternatives. The comments received from timber industry expressed the following concerns:

1. Perceived inadequacies of the CASPO report and insufficient peer review of this report.

   Regional Forester responded that he would investigate the adequacy of peer review with PSW.

2. Perception that there is no value in industry supplying an alternative to be considered since it will not have the blessing of Forest Service research scientists and therefore will not be considered credible.

   Joyce Muroaka requested that industry still provide help with alternatives despite their scepticism.

3. Industry expressed concern that they cannot survive under the CASPO recommendations, even over the next 2 to 3 years.

6/8/92: Meeting with environmental organizations with the same objectives as described. These groups expressed the following concerns:

1. The need to respond to the CASPO report quickly.

2. The need for an alternative that does more to maintain habitat for other late successional species than the CASPO recommendations will--i.e. an HCA-type of alternative.

3. Concerns with the adequacy of Alternative 4 as written (the combined CEA-CASPO Alternative).

4. Natural Resourses Defense Counsel (NRDC) stated that they would provide us with written comments shortly.

6/19/92: Legal Notice published in the Sacramento Bee. Public Notice summarized the scope of the interim guidelines analysis and requested public comment.

6/23/92: Mr. Larry Busby of the Central Sierra Planning Council called. He was responding to the mailing (distributed by the Stanislaus). He asked a number of questions about how this analysis process was initiated, the role of the Steering committee, effects to counties, the use of the term "interim," why the SOHA system is not considered adequate, about owl biology and why we have to complete a NEPA process to put these guidelines in place.

National Forests

Mail recipients included other agencies, elected officials, private individuals, and representatives of the media, environmental groups, business interests and the timber industry.

Angeles NF: Sent mailing to 2,000 people.

Eldorado NF: Sent mailing to approximately 300 people.

Sierra NF: Sent mailing to approximately 75 people on June 9, 1992. Sent press release to 120 newspapers, television and radio stations.

Lassen NF: Mailed letters and 2 page summary and Chapter One of the CASPO Report to 50 key contacts. News release sent to four TV stations, 10 radio stations and 12 newspapers. Local paper ran a story and one radio station in Redding ran a story. Unknown if other stations also ran stories.

Stanislaus NF: Sent mailing to 80 key contacts, called each later to inform of extension of comment period. Did a localized news release, sent messages to all employees, handed 15 packets out at a meeting with timber operators, hand carried packets to a few local residents who requested one, and had a stack of packets available at front desk for drop-bys.

Plumas NF: The Forest sent the information package to about 60 local key contacts, those with whom the Forest most often discussed timber/wildlife issues. The mailing list included school superintendents and supervisors of 5 counties, local environmentalists, local timber interests, and other key public figures. The Forest hand-delivered the local Quincy mailings; and mailed the remainder.

Tahoe NF: Sent package to Boards of Supervisors in Nevada, Placer, Sierra and Yuba counties as well as about 25 other key contacts. Mailed news release to about 28 local media outlets in these counties.

Sequioa NF: Sent mailing to 899 individuals.

Public Comments Received:

Over 400 letters, phone calls, and form letters, were received during the analysis period (June through December). All original letters and supporting documentation are on file and available for review in the Pacific Southwest Regional Office, 630 Sansome Street, San Francisco, CA 94111.

All public comments were considered and analyzed as a part of this Assessment. Some of the public comments expressed were general opinions on forest management, recreational opportunities, wildlife, spotted owl, timber harvest levels, jobs and the economy. Other comments were more specific and were useful in identifying issues, further defining the alternatives and possible effects. Most of the public comments are addressed in the Assessment, specifically in the Alternatives and Issues sections.

However, some comments received were not addressed in the document, but are summarized below:

Respondents felt that the public comment period was too short. Wanted more time.

The Forest Service did consider all comments throughout the assessment period (June through December)

Some respondents wished to "vote" for a particular alternative or position. This was accomplished through the use of form letters.

While this is valid input, the process is not intended to be an election or vote count.

Many respondents provided discussion and input on the CASPO Report. Some people questioned the science of the report while others wanted the Forest Service to adopt it immediately.

Many comments received were observations, expressions of opinion or statements of value.

*U.S. GOVERNMENT PRINTING OFFICE 1993-0-784-091/61019

APPENDIX B

Summary of primary recommendations for stand retention and special stand treatments to maintain options for spotted owls on public timberlands in the Sierra Nevada during an interim period.

Attributes	Protected 1/ Activity Centers	Selected 2/ Timber Strata	Other 3/ Timber Strata	Salvage Sales
Large, old trees Basal area	No logging	Keep 40 percent, from largest healthy trees and culls	Keep 30 percent, from largest healthy trees and culls Retain at least 50 square feet per acre	Does not apply
dbh 4/	No logging	≥30 inches	≥30 inches	Does not apply
Percent canopy cover	No reduction	≥40 percent	No restriction	No restriction
Snags	No reduction	Retain up to 8 snags per acre ≥ 30 inches in dbh. If less than 20 square feet per acre retain largest snags to a total of 20 square feet per acre but no more than 8 snags per acre	Retain up to 8 snags per acre ≥ 30 inches in dbh. If less than 20 square feet per acre retain largest snags to a total of 20 square feet per acre but no more than 8 snags per acre	Retain up to 8 snags per acre ≥ 30 inches in dbh. If less than 20 square feet per acre retain largest snags to a total of 20 square feet per acre but no more than 8 snags per acre
Dead-and-downed woody material	Retain largest downed wood, at least 10-15 tons per acre	Retain largest downed wood, at least 10-15 tons per acre	Retain largest downed wood, at least 10-15 tons per acre	Retain largest downed wood, at least 10-15 tons per acre
Fire threats	Light under-burning (see Chapter 12)	Positive fuels management	Positive fuels management	Positive fuels management

1/ Block of 300 acres of suitable nesting/roosting habitat delineated around nest site or primary roost site in all known spotted owl sites in the Sierra Nevada, as identified in the California Department of Fish and Game database.

2/ Timber strata selected for nesting by spotted owls in the Sierra Nevada (M4N, M4G, and better--strata codes explained in table 1C).

3/ Other timber strata used for nesting by spotted owls in the Sierra Nevada (M2G, M3P, M3G, M3N, M4P, R3P, R3G, R4G, R4N--strata codes explained in table 1C).

4/ Diameter at breast height, in inches.

revised January 21, 1993

CALIFORNIA SPOTTED OWL SIERRAN PROVINCE
INTERIM GUIDELINES ENVIRONMENTAL ASSESSMENT

ERRATA SHEET

p. I-2, paragraph 1, line 1: This action will commence after the decision is issued on these interim guidelines and after issuance of the PIP Team recommendations.

p. I-2, paragraph 4, line 1: The standards and guidelines will be in effect until the analysis process is completed and a longer-term management strategy is adopted to maintain viability of the owl.

p. I-2, paragraph 7, line 4: maintain

p. III-6, paragraph 6, line 1: Identify activity centers for all known and probable pairs or resident single spotted owls, that could be directly or indirectly affected by the project...

p. III-10, paragraph 5, line 5: Sierran

p. III-15, paragraph 7, line 2: experienced

p. IV-1, paragraph 5, line 1: The existing condition of the vegetation as it relates to spotted owl biology and other wildlife species will be discussed in the California Spotted Owl portion of this section.

p. IV-5, paragraph 4, line 2: Douglas

p. IV-20, paragraph 2, line 3: Under this alternative, approximately 22, 310 acres would be treated annually in 1993 and 1994 with 9,920 acres harvested with even-aged regeneration prescriptions.

p. IV-23, paragraph 5, line 4: Assuming harvest occurs in proportion to strata abundance, harvest within about 9,287 acres of habitat classified as Other strata would occur annually for the next two years...

p. IV-24, paragraph 5, line 1: As displayed in Figure 12, a total of 24,940 acres would be treated annually in 1993 and 1994, with 12,200 acres managed under the guidelines described in this alternative.

p. IV-26, paragraph 3, line 1: About 18,630 acres of total acres treated would occur annually in 1993 and 1994, with 7,300 acres managed under the guidelines described in this alternative.

p. IV-27, paragraph 3, line 2: As shown in Figure 12, 7,300 acres would be managed yearly under the prescriptions described in this alternative.

p. B-6, paragraph 3, line 4: According to the CASPO Report, canopy closures of 40 to 50 percent should be used to determine suitable habitat.

revised January 21, 1993